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THE EVOLUTION OF A *SAL* SEEDLING.

Considerable knowledge has been acquired during the last 10 years regarding the conditions which are most favourable for the production of *sal* regeneration, and information is gradually being obtained on the subsequent development of the seedlings. Mr. Collier*[1] in 1914 summarised and greatly added to our knowledge of the conditions of natural *sal* regeneration. The long series of researches and experiments by Mr. Hole*[2] on the œcology of *sal* seedlings threw a flood of light on their early development. Troup*[3] has made an admirable summary of our knowledge of this difficult subject up to 1919. Forest Ranger Ram Rattan*[4] of Gorakhpur produced very successful and vigorous artificial *sal* plantations and Wood has worked out the successful application to large scale operations, on lines very similar to the application of artificial *sal* regeneration in Bengal. The satisfactory solution of artificial *sal* regeneration throws considerable further light on the problem of natural regeneration, and the following note summarises in the briefest possible way the present state of our knowledge regarding the silviculture of *sal* regeneration, indicating what may be considered as definitely proved, and in what points our knowledge

*[1] Collier, Working Plan of 1914 for the Haldwani Division, U. P.
*[2] Hole, Indian Forest Records, Vol. V, Pt. IV.
*[3] Troup, Silviculture of Indian Trees.
*[4] Wood, *Indian Forester*, February 1922.

is still incomplete. It assumes that every student of the subject will have carefully read the literature and authoritative writers mentioned above, whose evidence and arguments will not therefore be repeated.

The evolution of *sal* seedlings may be considered under three sets of conditions:—

(1) Artificial regeneration. This naturally is much the simplest problem, as the *sal* seedlings are given the optimum conditions for growth, and the problem has been completely and satisfactorily solved over a wide set of conditions and by many investigators.

(2) Natural regenerations under favourable conditions of soil, moisture and growth. This is a far more difficult problem than the first, and a great deal still remains to be determined.

(3) Natural regeneration under adverse conditions, *i.e.*, on dry slopes, stiff soils, in poor quality *sal* forests, etc. This problem is entirely unsolved at present, and seems likely to remain unsolved for a long time to come.

Let us consider these three sets of conditions separately.

Artificial regeneration of sal.—This has been successfully accomplished under varying conditions of soil in different areas, notably—

(*a*) in the *bhabar* gravel soils of Dehra Dun, near the western limit of *sal*, with ever-recurring danger of frost.

(*b*) on dry stiff loamy soil of the *damar* forests of Bahraich (Motipur).

(*c*) on the moister loamy and clay-loam soils of Gorakhpur, in poor quality *sal* forests.

(*d*) on the fertile moist *tarai* soils of the Bengal Duars, in areas of optimum *sal* growth.

In every case it has been found that practically complete success can be *guaranteed*, given complete overhead light, thorough soil working, and freedom from competitive weed growth, and

from injury from animals or frost. An excellent description of the steps to be taken, and the details of resulting development of the seedlings to 8-9 months old has been given by Mr. Howard*[5] and need not be repeated here. The whole secret of success lies in this, that by these artificial means the *sal* seedlings are given optimum growth condition, which enable them to develop a splendid taproot (thus ensuring sufficient water-supply) and to store abundant reserves of food in the root stock to ensure continuous growth without the necessity of dying back, or even of delaying their development. Both factors (*i.e.*, water-supply and reserves of food) are of vital importance in the growth of a *sal* seedling, as will be explained subsequently. Where soil working and rains weeding can be done, and there is no danger of frost or serious damage by animals, there is not the least doubt that artificial *sal* regeneration is the safest and quickest method to adopt, and if in addition it is possible to carry it out with *taungya* the cost is reduced to very small proportions. In 1923, for example, Mr. Wood in Gorakhpur succeeded in making 63 miles of lines of very successful *sal* sowings (covering over 80 acres), despite a poor *sal* seed year and very late rains, at a total cost of under Rs. 150 by means of *taungya*. Unfortunately in the bulk of the U. P. *sal* forests neither *taungya* nor artificial regeneration with rains weeding are feasible propositions, and in many forests, the danger effectively prevents any attempt on a large scale, and so we have to depend principally on natural regeneration for the bulk of our *sal* forests.

Natural regeneration under favourable conditions.—As most of the best of the U. P. *sal* forests are rapidly being brought under some form of periodic block system of (mainly) natural regeneration, and the acid test of such system is that *we* can *guarantee* the successful regeneration of definite areas within a definite time the importance of solving the problem of natural *sal* regeneration is obviously very considerable. It is excusable therefore to deal with the evolution of the *sal* seedling under natural forest conditions at some length.

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*[5] Howard, *Indian Forester*, December 1918.

The first essential to the successful start of regeneration is the combination of a big seed year *with timely and adequate rainfall.* Past records and observations suggest that a certain amount of seed forms every 2 or 3 years, and there is usually a big seed year every 5 years, but we cannot safely reckon on the combination of ample seed and timely rain more than once in a decade while such phenomenally universal and successful years as 1913 probably do not occur more than 4 or 5 times in a century. There have been fair or big seed years in 1910, 1913, 1915, 1918, 1920, 1923, but of all these only in 1913 and 1918 and partly in 1920 were there timely rains as well (incidentally 1913 and 1918 were both famine years due to the early cessation of the rains). Thus the importance of utilising as much as possible the welcome years of big seed fall and timely rain needs no emphasising.

The next essential to success is a suitable germinating bed. In a well stocked fire protected *sal* forest, the *sal* seed falls on a mass of leaves, and when rain falls and germination starts, the rootlets of the small seedling winds about in the mat of leaves trying to get down to mineral soil. This makes it very difficult, in fact frequently impossible, for the seedling to develop in a healthy and vigorous manner. From the very start, the development of natural *sal* seedlings consists in a series of rushes, with long pauses for storing up nourishment for the next rush. Thus the nourishment stored *in the seed* enables the young seedling to rush up for 2 or 3 weeks, when further development of the aerial shoot slows down, and the rest of the growing season is largely spent in developing the root, and storing up nourishment in the hypocotyl for the future. If then the seedling has to spend a large portion of its precious and limited growing time with its root wandering about in the mat of leaves, it is practically doomed to subsequent extinction. The obvious practical remedy for this is departmental burning of regeneration areas in April as soon as the leaf fall is nearly completed, which has the additional advantage of materially reducing the dense herbaceous undergrowth found in all good quality fire-protected sal forests. This burning of regeneration

areas is now generally recognised and practised (except in dry *sal* forests) in most of the U. P. *sal* divisions.

With the burning of the leaf litter, our practical assistance to natural regeneration ceases. It is usually impossible to work the soil in April and May over large areas, since in the submontane forests labour has disappeared at that time, and anyway the whole expenditure may be wasted by absence of timely rains. The natural seedling is greatly handicapped compared to his artificial brothers, frost or the danger of invasion of tremendous weeds and grasses necessitate a certain amount of overhead or side shade, and *sal* seedlings always develop best in complete overhead light; the soil is unworked even if the leaf litter is removed, with the break of the rains, the herbaceous undergrowth springs up vigorously and further hampers the development of the *sal* seedling. Thus it is quite exceptional for the natural seedling to develop as the artificial seedling does, and with the advent of the cold weather, the mortality amongst the worst developed seedlings commences, and continues steadily through the succeeding months. With the coming of the hot weather a good proportion of the healthier seedlings which are destined to ultimate survival, die back, and the proportion of natural seedlings which never die back, at all is comparatively small. Under the practical working conditions of the U. P. forests, with the impossibility of extensive soil preparation and rains weeding and the necessity of protection from frost, it is difficult to see how this can be avoided. The suggestions made by Hole for securing natural regeneration (*vide* Troup's Silviculture of Indian Trees, Vol. I, page 96) are in effect practically artificial regeneration, and to a great extent impracticable in U. P. forests. But it has been definitely proved that, given timely rain, the enormous seedling production in a good seed year is sufficient to meet the high mortality that must occur, and still leave ample regeneration to cover the ground sufficiently with the survivors. Despite every drawback to which natural seedlings are subject, this fact is indisputable. We may therefore justifiably conclude that the successful natural regeneration of any good quality *sal* forest can be started possibly in 5 years, but with very fair certainty in 10 years, under practical working conditions.

We now have to consider the most difficult point and crux of the whole problem, how to ensure certain establishment of *sal* seedling regeneration in a reasonable time. The wonderful seedling regeneration noted by Troup*[6] in February 1914 in Lakhmandi block, now after 8 years of successful protection from fire and cattle grazing, and with light or moderate fellings of the overwood, has very largely disappeared, and this is but one instance of many that could be given of the gradual disappearance of most promising *sal* regeneration. Recent practice and Working Plans in Bengal and Gorakhpur show that the problem there has been largely avoided by the introduction of *taungya* and artificial work, and since Hole's proposals for accelerating the establishment period of natural regeneration (as mentioned above) include such operations as soil working, rains weeding, etc., it cannot be said that he has solved the problem of *real* natural regeneration without such adventitious aids.

Recent experiments in the U. P., carried out under practical working conditions, and with the careful exclusion of rains weeding, etc., have carried the problem a stage further. Let us continue the study of the evolution of a *sal* seedling from where we left off, that is with a good crop of 1 year old seedlings obtained by burning the leaf litter before a good seed year and timely rains, in the natural forest with moderate overhead shade and the inevitable weed growth. During April, May and June, the seedlings have used up their accumulated food reserves, those which have not died back in putting out new leaves, and increasing the shoot, and those which have died back in putting out one or more new shoots from the collar. With the advent of the rains, if the area has not been burnt, the carpet of dry *sal* leaves becomes a sodden and poisonous blanket, the evil effects of which Hole has so well explained, and simultaneously the *sal* seedlings are overgrown by the weed growth, so that the rains season, which is utilised by the artificial seedling largely in developing its root system and storing up reserves of food for its next burst, becomes for the natural seedling in the forest a time of struggle for existence, and the seedling is greatly handicapped in its efforts to develop its

*[6] Troup, Silviculture of Indian Trees, Vol. I, page 102.

root system or to store up food reserves. However the extraordinary tenacity for life exhibited by *sal* seedlings enables the seedling crop to carry on for several years under such conditions, and in seven or eight years, perhaps one or two seedlings out of a thousand will have developed to a size of 3′ or so, while perhaps 5 °/₀ or 10 °/₀ of the original crop will still be existing as plants 6″ to 2′ high, the remainder will have disappeared for ever. The cause of their disappearance is undoubtedly that the conditions of growth in the rains have at last made it impossible for them to lay up food reserves sufficient for the production of a healthy new aerial shoot when the old one dies back. The last stage of a disappearing *sal* plant is the production of a single small leaf on a minute and flimsy stalk, 2″ or 3″ long, and individual plants 7″ to 8″ high have been observed to dwindle down to this last stage in two rains.

The experiments started in 1920-21 in Lakhmanmandi block were designed to improve the conditions of growth in the rains, and although still incomplete, some interesting results have been obtained.

The seedlings were of the 1913 seed year, and the stage of development reached in 8 years of fire protection in several observation plots was roughly as follows:—

Under 9″ height	= 256	= 58°/₀	Average density = 1 seedling per square foot of ground surface.
9″—18″ „	= 108	= 25°/₀	
18″—24″ „	= 39	= 9°/₀	
Over 24″ „	= 34	= 8°/₀	
	437		

4 plots of 25 acres each were taken.

Plot I.—*Sal* clearfelled, light shelterwood of miscellaneous species left, conversion heavy, trampling and refuse considerable, fire fierce, not fired again since 1921.

Plot II.—Light shelterwood of *sal* (10—12 trees per acre) left, rest clearfelled. Conversion, refuse, etc., as in Plot I.

Plot III.—Left untouched and fire protected.

Plot IV.—Lightly thinned, complete *sal* canopy left, light ground fire burnt each year.

The results of this varying treatment after 2 years may be briefly summarised :—

(1) In Plots I and II, 50°/₀ plants still survive, those that have disappeared being chiefly under 9″ original height, and 25°/₀ of survivors show appreciable upward growth of 1′ or more, on the average those showing upward growth being mainly 9″—18″ class. The plants originally over 2′ height have tried hard to shoot up, but have been persistently checked by browsing of wild animals. The survivors generally look very healthy.

(2) In Plot III, 25°/₀ now survive, of which less than 8°/₀ show any upward growth at all and 75°/₀ have entirely disappeared. Most of the survivors look very unhealthy, dying back continues.

(3) Opening of the canopy and subsequent burning in Plots I and II has completely eliminated dying back, and the small plants remain perfectly healthy even under the strong growth of grass and weeds that has resulted from the heavy felling.

(4) On the other hand the upward development of the *sal* plants has been disappointing. The smaller plants are so interfered with by the weed growth in the rains that they cannot store up sufficient food reserves to send up vigorous shoots *yet*, although they are healthy and not dying back, while the larger plants (*i.e.*, 2′ and over) which obtain a fair amount of light, have endeavoured to shoot up vigorously, but their new shoots are persistently browsed by *chital* and *sambhur*. It is believed however that this is only a temporary phase.

(5) In Plot IV, the annual burning and fairly complete over head shade have materially reduced the weed growth, and the *sal* plants have remained much healthier than in Plot III, dying back in the rains being greatly reduced although not altogether eliminated.

The annual burning naturally causes a good deal of dying back in April due to scorching. The amount of natural regeneration

has been augmented by a successful seedfall (combined with timely rain) in 1923. It may here be noted that Collier has recorded abundant and almost universal *sal* regeneration 3′ to 5′ high in the well stocked good quality *sal* forests of Nepal, *which are annually burnt*, and considers that a heavy felling, followed by a few years of successful fire protection, will ensure the complete natural regeneration of these forests.

From these observed facts we may justifiably draw the following conclusions, which summarise the present state of our knowledge regarding natural regeneration in *good quality* moist *sal* forest :—

(*a*) When a good seed year coincides with sufficient well distributed rain at the right time, abundant regeneration will be started, even under a fairly complete canopy, especially by previously burning the leaf litter, and leaving a clean floor.

(*b*) Such regeneration will persist for several years even under fairly heavy shade and weed growth, but its development and healthy existence will be stimulated by judicious early burning (*i.e.*, up to 10th, or 15th April) either annually or at intervals of 2 or 3 years. Late burning *i.e.*, in May) is absolutely fatal to such seedlings, since they have by then largely used up their food reserves, and can send out either no new shoots at all, or only very miserable ones.

(*c*) Collier's observations in Nepal suggest that annual or periodic burning of comparatively moist and well stocked *sal* forests of good quality will in time give good regeneration before the final fellings begin. How much time is required we do not know, but we believe that judicious burning of properly thinned *sal* crops approaching maturity for some years before final or heavy regeneration fellings commence (*i.e.*, while the areas are still in a P. B. II) will considerably assist us in solving the problem of their regeneration when they are put into P. B. I. This

point is however by no means definitely proved yet.

(*d*) We know that *sal* plants 3′ or more in height will benefit by drastic felling of the overwood, we believe that such plants will in time grow out of reach of browsing by deer, but we do not yet know how long they will take.

(*e*) We know that a heavy felling over quite small plants (*i.e.*, under 2′) greatly improves their healthy appearance, but we are not yet certain whether such little plants will be able to grow up through the competing weed growth, and if they can, how long they will take. In future, however, we hope, by heavy thinnings and judicious burning, to get the regeneration 2′ or more high before heavy regeneration fellings commence.

This briefly summarises the present state of our knowledge of natural *sal* regeneration without the adventitious and frequently impracticable aids suggested by Mr. Hole. There are still many gaps to fill up, but we believe our knowledge has advanced sufficiently to justify the adoption of a Periodic Block or Quartier Bleu system of management *with a long regeneration period* for good quality *sal* forests of the type dealt with above.

5. *Natural regeneration of dry sal forests of poor quality* — Areas typical of this type of forest are the drier ridges and slopes of Siwalik sandstone of the Western Circle, the dry Jaspur Range forests, the poorer *sal* areas of Tulsipur, etc At present we frankly know nothing of the natural regeneration of such areas and since for many of them the quality of locality, and means of extraction are so poor that expensive artificial regeneration cannot be justified financially, we are not in a position to guarantee the regeneration of definite blocks within a definite time either by natural or artificial means, and hence we cannot manage such forests under any scientific or systematic system of concentrated regeneration. For this reason they are perforce relegated to Selection-cum-Improvement or Simple Improvement fellings until the question of their regeneration can be tackled

6. Thus the detailed study of the evolution of the *sal* seedling which has been carried out during the last 10 years by many forest officers in many places has had an important influence on the systematic management of our *sal* forests. The solution of the problem of artificial regeneration enables us with complete confidence to adopt clear felling, where intensive demand for all forest produce exists and artificial regeneration can be carried out on a large scale in practice. Mr. Hole's illuminating researches on the œcology of the *sal* seedling, and practical application of these researches to forest conditions justifies us in believing that we can guarantee to regenerate definite blocks of *good quality sal* forest in a definite time, mainly by natural means, and this justifies us in bringing such forests under some scientific system of concentrated regeneration by periodic or floating regeneration blocks, with a long regeneration period. If there be any who cavil at this claim, there can at least be no denying that we are much more justified in introducing such systems than Howard and Collier were 8 and 10 years ago (when they commenced the Conversion to Uniform Working Circles for Bhabar forests of Ramnagar and Haldwani Divisions), and our present justification has increased by the amount that our knowledge of the evolution of the *sal* seedling has increased during that interval.

E. A. SMYTHIES, I.F.S.

DOWN IN THE FOREST SOMETHING STIRRED.

It was not even an illicit felling nor indeed was it Von Mantel looking for his mutilated formula—it was a large old *mohwa* being removed at last to the great relief of a patch of teak saplings.

One's first general impression of the forests of the C.P. is that they consist of vast areas of scrub growth whose inability to yield much other than poles and firewood is in some measure compensated by a fortunate if fortuitous tendency to produce lac in certain areas.

These impressions, which have no very definite origin, certainly prove correct for a few areas but on the whole they have created and fostered the entirely false idea that the application of

systems approaching those of European forestry in these provinces is but the mirage-like ideal of a few misguided if well intentioned enthusiasts.

When conservancy was first begun in the C. P. the obvious needs were urgent ones of replacing an almost universal crop of badly grown trees and unsightly pollards by a straight, well grown crop; of restocking denuded or devastated areas; and of encouraging valuable species previously hacked out by the various local opportunists in need of them. Further, areas not so badly treated had to be safeguarded against the possibility of such damage, and the total area was to be protected and improved till forests worthy of more detailed and discriminating management were evolved.

These first admirable and highly logical intentions resulted in the production of working plans—all of monotonous sameness which were excellent at the time and most necessary. They embodied plain rules to be obeyed as first principles of forest policy,—but they were never intended or designed for the rigid and lengthy application which has been their lot.

Many of the old plans have been in use for nearly (and in some cases more than) 30 years—without revision or any radical alterations in their now antiquated provisions. In fact in some cases the present need is to save the crops to which they refer from the effects of the latter because large areas of the forests of the province have undergone fundamental changes in stocking and composition.

It is now being realised that by change of method of exploitation we can expect to produce high forest of good quality—that is good compared with the growth of previous years—of at least teak. Not only must the old plans be rewritten and revised but old ideas of the incapability and impracticability of any but the old and wasteful methods must be radically altered.

Formerly the common practice was to sell coupes (by auction) in which trees to be reserved were marked. The contractor was compensated and encouraged at the expense of the forest in that good young teak, etc, were frequently left unmarked The result was and still is (forests being so constituted that they long bear the marks of their previous handling), that over vast

areas badly shaped old trees, often of inferior species, stand over the new generation of coppice shoots. These should of course have received attention in the Departmental "cutting back operations" following the felling which theoretically remove the bad trees that a gently treated contractor was not accustomed to being made to fell. However the funds and staff available for cutting back operations were hopelessly inadequate and the forest often remained in practically the same condition as that in which the contractor left it. Sufficient money was not forthcoming to leave each coupe in a decent condition just after felling—it is therefore not difficult to understand that any opportunity of revisiting the young crops of coppice shoots forming the forest of the future was absent. The present ideal however is now to mark our coupes with a view to the actual improvement of the forest (the former system theoretically had the same object) by marking bad old trees, young trees to be removed in a thinning operation, the worst of 2 or more coppice shoots, etc., all in one, and to ensure that the marking does not lose its silvicultural validity (by insistence on contractors felling all marked trees in the future). Of cases where contractors have been educated to the complete removal of all trees marked—whether they wish to or not, we have fortunately an outstanding example in Bhandara Division which is in striking contrast to the majority of others. The application of the principles is practicable but depends on the firmness of the D. F. O's. and their putting silviculture which involves larger subsequent and sustained yield—before the production of immediate revenue.

Given the combined silvicultural and cutting back, climber-cutting, and general improvement marking operation referred to above, there remains the need for revisiting our congested pole crop—at a first approximation every 10 years. This is essential and is being urged. The old working plans (which did not provide for a definite thinning scheme) are now to be revised and rewritten and it is the present intention to endeavour to thin our promising young crops even to the abandonment of schemes for working virgin areas under old methods. Stock maps will be a novel feature of the new plans and the education of contractors to

fresh and highly distasteful methods essential to sound working (such as felling by sections, etc.), will result in the more efficient favouring of our many long suffering valuable species.

Rumour has it that once we were known as the bow and arrow province by Dehra Dun where our former research has not always found favour or even been in particularly good odour. It may be that we can do better now that we have borrowed their firearms.

As an earnest of recent recognition of the need for organised research in the province a silviculturist has been appointed. The results of the diverse experimental work carried on for years by D. F. O's. and others are now gathered together and recorded in order. Our sample plots are now made to conform with Dehra Dun methods, and future work will be able to be compared with that on similar lines in other provinces.

Our immediate need is for volume tables of teak and sal at least to enable the sale of coupes to be effected on a less speculative basis.

The average C. P. division is of an area of about 800 square miles—the staff has been inadequate, and the funds granted hitherto for forest work far from proportionate to the steady increase in revenue yielded in recent years. A more favourable era is now commencing (for the C. P. forests); more substantial funds have been granted; cultural operations never before hoped for can now be at least tentatively begun while a reorganisation of the staff is under examination. Our young straight crops of teak and other species already inspire us with visions of something better than the conventional coppice crop of 30 years and we now look forward to the creating of forests in which the half forgotten and long neglected methods of Europe may come into their own.

"Meliorasperamus"—a comfortable remark in spite of being the motto of the I. F. S. has here in the past been taken too literally. Compliance with the spirit of it was perhaps rendered difficult by what amounted to the relegation of the selective improvement operation to the financially biassed whims of the

noble army of contractors or to the vernacular silviculturists who masquerade as forest guards.

It was no doubt hard to hope for better things in the past but the time has now come to assist on a large scale our long suffering and surely recovering forests.

We would in fact announce our intention to do a little forestry at last.

Some there be who write to this magazine about alterations to classic formulæ—others contribute copies of notes taken during practical tours on the Continent—while others again write poems about lonely bison bulls and the like.

That the above will serve a purpose at least as useful is the hope of

V. K. MAITLAND, I.F.S.

SLEEPER TREATMENT IN INDIA.

As long ago as 1909 preliminary experiments were started by the Forest Research Institute at Dehra Dun with the object of determining whether or not the treatment of sleepers by antiseptics was possible on commercial lines in India. Such experiments entail determining whether any given antiseptic is suitable under Indian conditions, and whether species of which sufficient supplies are available at reasonable rates lend themselves to treatment, and finally whether these species when treated are durable under service conditions.

To settle the first point a variety of antiseptics were selected, which naturally grouped themselves into two classes, namely, oil derivatives and salts. Of these the former give far superior results to the latter. The next point was to select species on which to carry out durability tests, and due to financial considerations and to the want of proper apparatus in which to treat the sleepers the number of species had to be restricted to five, namely, two pines and three broad-leaved species. Finally some 7,980 sleepers of these five species were treated, four different methods of treatment being used; the antiseptic being

introduced either in open tanks or by means of a small pressure cylinder. The results of these experiments are given in detail in Indian Forest Records, Vol. VI, Part IV and Vol. IX, Part I.

The durability tests have now been in progress some 11 to 12 years, and in the case of powellised and creosoted sleepers the results of these experiments have been so satisfactory that the railway authorities have now taken pratical steps to show their confidence in treated sleepers by creating a large pressure creosoting plant at Dhilwan on the North-Western Railway. Another pressure creosoting plant has been erected by the Assam Railway Trading Co. in North Assam, where the experiments to treat sleepers under pressure were first carried out by the Forest Research Institute.

The Dhilwan plant consists of one cylinder, 75 ft. long and $7\frac{1}{2}$ ft. diameter, capable of dealing with about 1,200 B. G. coniferous sleepers a day, or approximately 350,000 B. G. sleepers a year. The plant is fitted with two powerful oil pressure pumps, two air pressure and vacuum pumps, a high and low level service tank fitted with heating coils, and a powerful up-to-date adzing and drilling machine, to which are attached end-trimming saws. The accompanying photograph gives an idea of the plant, which is fed by two small engines which haul the loaded trucks into the cylinder for charging purposes. These engines are of the narrow gauge type, while the whole sleeper yard surrounding the plant is served by broad gauge sidings connecting with the main line. The layout is so arranged that the plant can be expanded, and two more treating cylinders could be added, so as to bring its treating capacity up to more than a million B. G. sleepers per annum.

The species of timber being treated at present are "*Chil*" or "*Chir*" Pine (*Pinus longifolia*), Spruce (*Picea Morinda*) and Silver Fir (*Abies Pindrow*), on which strength and antiseptic tests have already been carried out in the laboratories of the Forest Research Institute. The former species especially lends itself to easy treatment, and is an extremely useful sleeper when treated; the two latter are rather more difficult to deal with, as it

North Western Railway, creosoting plant. Dhilwan (Beas).
Sleepers being removed from cylinder on trucks.

Abnormal chital head contrasted with a normal head.

is difficult to treat the sides completely, though end penetration is very satisfactory. There is however little doubt that by slightly modifying the present process this difficulty can be overcome.

The question of treating broad-leaved timbers presents even a more attractive proposition than treating coniferous woods. For one thing the conifers in India are confined to the hill forests, and therefore represent only a very small proportion of the total available supply of those timbers which are suitable for treatment. From experiments already carried out in the experimental pressure plant now installed at Dehra Dun it is evident that the *Dipterocarps*, of which large quantities are available in Burma, Assam and the Chittagong Hill Tracts, will treat easily; while the durability tests carried out for over 10 years show that these timbers are very durable after treatment, and have a life in the line of approximately 10 years. Many other Indian species treat well, more especially *sain* or *asna*, known in Burma as *taukkyan*, a very hard wood and eminently suitable for sleeper work. Finally if this question of treating sleepers antiseptically is to be taken up on a large scale it is most essential that suitable centres of collection are chosen where a large number of sleepers can easily be collected, and where treating plant can be erected. If this is done, not only will the question of supplying sufficient sleepers to Indian Railways be largely solved, but it will have the further beneficial effect of stabilising the sleeper market and finding a new use for many of our Indian hardwoods.

R. S. PEARSON, I.F.S.,
Forest Economist.

AN ABNORMAL CHITAL HEAD.

I send you for publication, a photograph of a freak of nature in the way of a pair of Chital (Spotted Deer) horns.

I first observed the stag carrying these about the end of April 1921 when I was shooting in a little visited shrub jungle in the hope of securing one of the good heads I knew were there.

I shot a stag in very open jungle and the report of my rifle put up seven hinds and one stag (this freak). The stag ran to my left and stood on a ridge barely 100 yards away and I could not but immediately notice the extraordinary horns which he carried. He gave me a splendid shot, broadside on, but I missed him and later discovered that the second leaf of the backsight was up. I promptly followed the herd and saw them crossing a piece of open country, making for another patch of jungle and I emptied my magazine at the stag but with no result. I continued following them up and came across the stag who had his horns badly entangled in a big *karonda* bush and making frantic efforts to get loose, but before I could get round for a shot he disentangled himself and disappeared, and though I searched the jungle thoroughly in a scorching sun all day, I never saw him again on this occasion.

On another visit to the same jungle I did not come across this stag but on a third occasion I saw him again and this at the end of the day when I had given up all hopes as I had worked hard in a thorough search of the surrounding jungles.

I was returning to my headquarters through the jungle when I saw a couple of hinds with a good stag looking at me and shot the stag and when they made off, I discovered to my chagrin that the object of my search was in the herd. I took a running snap shot but another Cheetal (female) intercepted and so I again lost the trophy, the possession of which had now become an ambition if not an obsession. Unfortunately, I did not get an opportunity to go out again.

In August I sent my *shikari* out to see if the stag was still there and report on the condition of his horns and he brought in the horns numbered (2) in the photograph, these had been picked up by a grazier, in the vicinity.

From then onwards I had him very closely watched to see if he would grow freak horns again which he did and in April 1922, having been informed that his horns were no longer in velvet, I went out and shot him with the horns, numbered (1) in the photograph.

Quite apart from being an abnormal freak, it clearly establishes that freak horns are permanent and not only confined to one set. I may mention here that besides this freak, the stag had no other visible defect about him which I could detect.

The horns numbered (3) are those of a natural head ($36\frac{3}{4}$"), in order to show the vast contrast.

B. A. PARR,
Inspector of Police,
Central Provinces.

SUMMARY REPORT AND RESOLUTIONS OF THE BRITISH EMPIRE FORESTRY CONFERENCE, CANADA, 1923.

SUMMARY REPORT.

1. The Second British Empire Forestry Conference consisting of the delegates from the Empire whose names are given herewith, assembled in Ottawa in July 1923. The delegates sat in full session on July 25th and September 7th, and in committee on fifteen occasions between those dates.

Discussions were held both at Ottawa and during the course of an extensive tour arranged by the Dominion Government through forests in all the provinces with the exception of Prince Edward Island and Nova Scotia.

PROCEDURE.

2. Following the precedent of the first Conference held in London in 1920, the Conference opened its official business with the presentation and summary description of the contents of prepared statements on forestry in the different parts of the Empire. The progress made in giving effect to the resolutions of the 1920 Conference was then reviewed.

3. From that point the Conference proceeded to deal in the first instance with questions of Empire interest; secondly, with matters of pressing interest to the country in which the Conference was being held; and thirdly, with such matters of unusual importance to other parts of the Empire as could conveniently be included in the agenda.

Resolutions of the Conference of 1920.

4. In reviewing the action taken on the Resolutions of the 1920 Conference, the present Conference was able to mark definite progress in certain directions. As regards those dealing with Forest Policy, Survey of Resources, and Constitution and Status, notable advances have been made, although there still remains much to be done. Since these matters of fundamental importance have not yet been fully achieved, the Conference found it necessary to reaffirm them. (Resolution No. 1). With regard to the organisation of Forest Industries, it would appear that the forest authorities and the industries are gradually getting into closer touch and that by such contract a keener appreciation by each of the objects and work of the other should be brought about; similarly, with regard to publicity, that the general public have been given a fuller statement than ever before of the aims and purposes of forest policy.

On the other hand, several of the proposals embodied in the resolutions of the 1920 Conference are either in suspense or have not been brought to full fruition, owing mainly to the abnormal financial conditions which have prevailed. It was proposed to set up in the United Kingdom a Central Institution for the training of forest officers, and to create an Empire Forestry Bureau (to which were to be referred the standardisation of forest terminology and the standardisation of trade names). Adequate assurances of financial support were not forthcoming, and it was deemed expedient not to proceed with the proposals for the time being but to refer them to the present Conference. A Forest Products Board has been set up in the United Kingdom, but with inadequate powers. It is to be noted that in other parts of the Empire the question of forestry training and research have also lagged behind the proposals of the 1920 Conference.

Discussion of Questions of Empire Interest.

5. Turning now to the new work of the Conference, an attempt was made to survey the softwood resources of the North American continent and of Europe as a preliminary to the study

of the world's resources. The Conference was greatly indebted to Colonel Greeley, head of the United States Forest Service, for a paper on the subject of The Resources of the United States, and to Colonel Graves, who presented the paper on Colonel Greeley's behalf. This discussion, while not final in character was sufficiently precise to show the great drain which is taking place on the coniferous forests of the world, the disparity between the annual growth and the timber cut, and consequently the necessity for each individual part of the Empire to conserve and augment its own resources of growing timber. (Resolution No. 2).

Proceeding from the question of resources, the Conference considered the question of trade in forest products within the Empire. Owing to lack of time and the difficulty of obtaining complete statistical data while on tour, the Conference was unable to complete its investigation, which was referred to a Standing Committee. The great import trade of the United Kingdom and the export trade of Canada are both mainly with nations outside the Empire, and there are substantial economic reasons why such must continue to be the case. On the other hand opportunities for increased Empire trade undoubtedly exist. (Resolution No. 3).

6. The Conference then considered a group of closely related problems concerned with the general development of forestry from the Empire point of view, namely, the setting up of an Empire Forestry Bureau, the furtherance of the work of the existing Empire Forestry Association, the establishment of a Central Institution for the training of forest officers, and the functions of the Forest Products Board. It was felt that while it is undoubtedly desirable in the interests of economic development that all these institutions should be functioning, it is not practicable at the present time to proceed with them all. The members of the Conference, therefore, decided to recommend to their Governments that, without prejudice to the larger aims when financial conditions are better, a beginning shall be made with the Central Training Institution (Resolution No. 4) and that pending the setting up of a Forestry Bureau, the Empire Forestry Association shall be asked to devote a section of its journal to the

publication of purely official and technical information. (Resolution No. 5). The assembling of this material would be in the hands of a Standing Committee of the British Empire Forestry Conference. In view of the fact that the Australian Government had issued an invitation for a third Conference to be held in Australia, the value of a Standing Committee to act as a link between the second and third Conferences was held to be very great, and advantage was taken of this to impose on the Committee the further duties referred to above (Resolution No. 6).

The Conference noted with satisfaction the formation of a Forest Products Research Board in Great Britain and urged that its functions be so extended that it may be enabled adequately to attack also to many problems of a commercial or quasi-commercial character which await solution in Great Britain and those parts of the Empire which have no Forest Products Laboratories of their own (Resolution No. 7).

Canadian Problems.

7. With regard to the second category of problems, namely, those chiefly of Canadian interest, the Conference dealt at some length with fire protection and silviculture. In their extensive journeys through Canada the delegates could not fail to be impressed by the incalculable damage which has been wrought by forest fires, and of the necessity of preventing and controlling them. This, they believe, is not an impossible task. The first essential is public support, which must be obtained by education and publicity. The forests of Canada are of such enormous extent that there must be concentration of effort on the more valuable areas which should be permanently dedicated to forest purposes. Proper direction of settlement into forest regions and provisions for unity of control, together with proper slash disposal, will enable forest authorities to solve the problem of securing adequate fire protection.

The delegates were also greatly impressed by the extensive waste prevalent in most of the logging operations and saw-mills which they visited. While this waste is doubtless due in large measure to the local economic conditions of the industry, it is

responsible for the loss of much national wealth, and, in the interest both of Canada and of the Empire's timber supply should be reduced to a minimum.

The Conference recorded its belief that the time is ripe for a beginning to be made in the practice of more scientific silviculture than has yet been attempted in the Canadian forests. The observations which the delegates offered on these points were made with a full knowledge that there are many difficulties in the way, but they were confident, that profiting by the experience of countries which have successfully passed through similar difficulties, the systematic cultivation of her forests will greatly enhance the ultimate prosperity of Canada. (Resolution No. 9).

Local Problems.

8. With regard to items of interest to other parts of the Empire, shifting cultivation received the most detailed consideration as being of unusual importance in certain of the tropical colonies and protectorates as well as in India and Burma. (Resolution No. 10).

Next Conference.

9. It was unanimously agreed that the invitation of the Government of the Commonwealth of Australia to hold the next Conference in Australia be accepted and that 1928 be suggested as a suitable time. (Resolution No. 11).

Vote of Thanks.

10. The Conference concluded with a hearty vote of thanks to the Government of the Dominion of Canada, the Provincial Governments and those Associations and individuals who contributed to make the visit of the delegates profitable and pleasant. (Resolution No. 12).

RESOLUTIONS.

The Conference passed the following resolutions which the delegates undertook to bring to the notice of their respective Governments.

1. Forest Policy.

Believing them to be well-founded, this Conference reaffirms Resolutions 1, 2 and 3 of the 1920 Conference, which emphasise the great importance of each part of the Empire laying down a definite forest policy, surveying its resources of timber and ensuring that certain elements of stability are secured in the constitutions of Forest Policy. These resolutions are as follows :—

1. *Forest Policy.*—"In view of the great importance to the Empire as a whole, as well as to each of its component parts, of producing a sustained yield of all classes of timber, and of encouraging the most economical utilisation of timber and other forest products, and of maintaining and improving climatic conditions in the interests of agriculture and water-supply, each of the Governments of the Empire should lay down a definite forest policy to be administered by a properly constituted and adequate forest service.

2. *Survey of Resources.*—The foundation of a stable forest policy for the Empire and for its component parts must be the collection, co-ordination and dissemination of facts as to the existing state of the forests and the current and prospective demands on them.

3. *Constitution of Status.*—In order to attain continuity in the development of forest resources it is desirable that certain elements of stability be secured in the constitution of the forest policy. This may be done by the following measures :—

(1) The definition where this has not been done already of forest policy in a forestry Act or Ordinance.

(2) The reservation for the purpose of economic management, and development of forest land under conditions which prevent the alienation of any which is primarily suitable for forests except for reasons consistent with the maintenance of the forest policy as a whole.

(3) The assurance to the forest authority of funds sufficient to carry out the accepted policy for a series of years.

(4) The grant to members of the forestry service of the status of civil servants with due provision for pension.

(5) The appointment as the chief officers of the forestry service of persons having a high standard of training in forestry, their selection and promotion being by merit alone.

(6) The establishment in each of the larger parts of the Empire and for the Colonies not possessing responsible Government collectively, of an officer or officers having special duties of advising as to forest policy and surveying its education.

2. Softwood Resources.

In view of the great and increasing drain on the softwood forests of the world, it is incumbent on every part of the Empire to conserve and augment its own resources of growing coniferous timber.

3. Empire Trade in Forest Products.

This Conference is of opinion that the Empire's requirements of timber and other forest products should be supplied to the greatest possible extent from sources within the Empire.

That while economic and geographical considerations may preclude the exclusive use of Empire timber, the trade between units of the Empire can be largely increased.

That the Empire can become self-supporting in almost all minor forest products.

That, with these aims in view, active steps should be taken throughout the Empire to organise and foster trade.

This Conference, owing to difficulties of time and access to documents, has not been able to complete its investigations into this subject, and recommends that it be remitted to the Standing

Committee on Empire Forestry for presentation to the Imperial Economic Conference which meets in London during October next.

4. EDUCATION (CENTRAL INSTITUTION).

This Conference strongly endorses the view held by the 1920 Conference that a Central Institution for post-graduate and specialised training in forestry, combined with research, is essential to the proper development of the forest resources of the Empire, and regrets that owing to abnormal financial conditions the setting up of such an institution has had to be postponed. This Conference approves the report of its Committee appointed to enquire into this subject, and urges the departments concerned to take immediate steps to inaugurate a Central Institution for forestry training and research at Oxford University, so that if possible, it may begin to function at the opening of the next academic year, *i.e.* in October, 1924.

5. BRITISH EMPIRE FORESTRY ASSOCIATION.

This Conference welcomes the incorporation by Royal Charter of the Empire Forestry Association, under the Presidency of H. R. H. The Prince of Wales, and commends its work to all interested in the forests of the Empire. This Conference considers that the *Empire Forestry Journal*, issued periodically by the Association should be the medium for the publication of official and technical information; that pending the formation of an Empire Forestry Bureau, this information should be collected and prepared by the Standing Committee on Empire Forestry (see Resolution 5) assisted by technical correspondents in all the Forest Departments of the Empire.

This Conference endorses the recommendations of the Committee appointed to consider this subject.

6. STANDING COMMITTEE ON EMPIRE FORESTRY.

With a view to maintaining continuity of action in respect to meetings of the British Empire Forestry Conference, this

Conference recommends the establishment of a Standing Committee which should consist of—

The Chairman of the Empire Forestry Conference,

The Technical Commissioner of the British Forestry Commission,

The Head of the proposed Central Institution for Education,

One representative from each of the following:—

Colonial Office,

India Office,

The unit of Empire in which the last Conference was held,

The unit of Empire in which the next Conference will be held,

A member of the Council of the British Empire Forestry Association who has had experience in Colonial Administration.

With power to add to their number.

7. INVESTIGATIONS INTO FOREST PRODUCTS.

This Conference notes with pleasure the steps taken in Great Britain to form a Forest Products Research Board, but urges that the scope of the Board's work be extended considerably so that, in addition to fundamental research, it may undertake investigations leading to the application of the results of research to commercial practice, in accordance with the methods which had been found profitable in the U. S. A., Canada and India. This Conference further urges that immediate steps be taken to establish in Great Britain a well-equipped Forest Products Laboratory.

8. FOREST FIRE PROTECTION, CANADA.

The widespread damage to timber, property and life resulting from uncontrolled forest fires is a menace to the economic well being of the British Empire, and constitutes the greatest single deterrent to the practice of forest management. The Conference endorses the report of its Forest Fire Protection Committee, believing that the forest fire problem, though difficult, is capable of solution if the forest authorities receive full public support and the requisite assistance from the Government.

9. Silviculture, Canada.

In view of the disastrous effects of fires, insects and fungi upon the supplies of standing timber, and of the results of the existing logging methods in impoverishing the forests of their valuable species and in impairing their regeneration, this Conference strongly recommends the application of the more effective silvicultural methods to the Canadian forests and commends the report of the Committee on Silviculture to the earnest consideration of the Dominion and Provincial Governments and of the timber industry.

10. Shifting Cultivation.

The practice of shifting cultivation except when controlled as an integral part of forest management is a serious menace to the future welfare of certain portions of the Empire. The recommendations made by the Committee appointed to consider and report on this question are approved by this Conference, which urges Governments concerned to take such measures as may be necessary to deal with the situation.

At the same time this Conference recognises that, if strictly controlled, shifting cultivation may, under certain conditions, be made to serve a useful and even a necessary purpose in silvicultural operations, particularly in connection with the formation of plantations. When applied to such useful ends this Conference favours its encouragement, under control.

11. Next Conference.

This Conference accepts the gracious invitation of the Government of the Australian Commonwealth to hold the next meeting in Australia and requests the Commonwealth representative, Mr. Owen Jones, to convey to his Government a message of cordial thanks and appreciation. At the same time this Conference wishes to place on record its opinion that if suitable to the Commonwealth Government, the year 1928 would be the date most suitable for the meeting.

12. Vote of thanks.

This Conference places on record its most grateful thanks to the Federal and Provincial Governments of Canada for the hospitality, care and attention which they have shown the delegates throughout their stay in Canada.

The delegates also wish to thank the civic authorities, universities and private associations, mill owners, lumbermen and private individuals whom they met in the course of their five thousand mile tour for their welcome and acts of kindness and also for the way in which there has been placed at their disposal information which has materially added to the interest and value of the work of the Conference.

List of delegates.

Great Britain.—

Major-General Lord Lovat, Kt., K.C.M.G., D.S.O., etc., Chairman, Forestry Commission.

R. L. Robinson, O.B.E., B.A., B.Sc., Commissioner, Forestry Commission.

A. W. Borthwick, O.B.E., D.Sc., Education, Research and Publications Officer, Forestry Commission.

Fraser Story, Intelligence Officer, Forestry Commission.

Captain J. W. Munro, D.Sc., B.Sc. (Agr.), B.Sc. (For.), Entomologist, Forestry Commission.

Sir James Calder, C.B.E.

Lieut.-Colonel G. L. Courthope, M.C., M.P., Chairman, British Empire Forestry Association.

Prof. R. S. Troup, C.I.E., M.A., D.Sc., School of Forestry, Oxford University.

Australia.—

Owen Jones, B.A., Chairman, Forestry Commission of Victoria.

India.—

W. A. Robertson, Deputy Conservator of Forests, Burma.

C. G. Trevor, Conservator of Forests, United Provinces.

Irish Free State.—

A. C. Forbes, O.B.E., Forestry Branch, Department of Agriculture.

New Zealand.—

Captain L. McIntosh Ellis, B.Sc., F. Director of State Forests.

South Africa.—

C. E. Legat, B.Sc., Chief Conservator of Forests.

W. S. Johnstone, Associated Chambers of Commerce.

Crown Colonies.—

Colonial Office—

Major R. D. Furse, D.S.O., Assistant Private Secretary for Appointments.

Nigeria.—

J. R. Ainslie, D.F., F.L.S., F.R.G.S., Senior Conservator of Forests.

Kenya.—

E. Battiscombe, Conservator of Forests.

Ceylon.—

R. M. White, B.A., D.F., Deputy Conservator of Forests

Straits Settlements and Federated Malay States.—

G. E. S. Cubitt, F.R.S., S.S., Conservator of Forests.

British Guiana.—

L. S. Hohenkerk, Forestry Officer, Department of Lands and Mines.

Canada Dominion.—

E. H. Finlayson, B.Sc., F., Acting Director of Forestry.

D. Roy Cameron, B.Sc., F , Dominion Forest Service.

British Columbia.—

P. Z. Caverhill, B.S.F., Chief Forester, Provincial Forest Service.

New Brunswick.—

G. H. Prince, B.S.F., Chief Forester, Provincial Forest Service.

Nova Scotia.—

J. A. Knight, K.C., Commissioner of Forests and Game.

Ontario.—

E. J. Zavitz, M.S.F., Provincial Forester.

Quebec.—

G. C. Piche, M.F., Chief of Forest Service.

HONOURARY DELEGATES.

Mr. A. Bedard, M.F., Assistant Chief of Forest Service, Quebec, Dean of Laval Forest School.

Mr. Robson Black, Manager, Canadian Forestry Association.

Mr. W. C. Cain, Deputy Minister of Lands and Forests, Ontario.

Mr. Roland D. Craig, B.S.A., F.E., Forest Resources Specialist, Dominion Forest Service.

Mr. M. A. Grainger, President, Canadian Society of Forest Engineers.

C. D. Dowe, Ph.D., Dean of Faculty of Forestry, University of Toronto, Vice-President, Canadian Forestry Association.

Mr. Clyde Leavitt, M.Sc., F., Chief Fire Inspector, Board of Railway Commissioners, Canada.

Lieut.-Colonel T. G. Loggie, Deputy Minister of Lands and Mines, New Brunswick.

Mr. G. R. Naden, Deputy Minister of Lands, British Columbia.

The Earl of Strafford, England.

Mr. Ellwood Wilson, Chief, Forestry Department, Laurentide Paper Co.

ASSOCIATE DELEGATES.

Mr. L. R. Andrews, B.Sc., F., District Forester British Columbia Forest Branch.

Mr. E. Beck, Secretary, Canadian Pulp & Paper Association.

Mr. Loren L. Brown, B.Sc., British Columbia Trade Commissioner.

Mr. H. R. Christie, B.Sc., F., Dean, Forest School, University of British Columbia.

F. C. Craighead, Ph.D., Entomological Branch, Dept. of Agriculture, Canada.

Mr. R. P. Dalley, Empire Forestry Association.

Mr. J. W. Greenway, Commissioner of Dominion Lands.

Mr. E. W. Hamber, President, Timber Industries Council of British Columbia.

Mr. J. B. Harkin, Commissioner of Dominion Parks.

Mr. Frank Hawkins, Secretary, Canadian Lumbermen's Association.

Mr. Ralph Hopping, Entomological Branch, Department of Agriculture.

Mr. C. K. Howard, General Tourist Agent, Canadian National Railways.

Dr. C. C. Jones, M.A., Ph.D., LL.D., Chancellor, University of New Brunswick.

Mr. W. Kynoch, F.E., Superintendent, Forest Products Laboratories of Canada, Dominion Forest Service.

Mr. D. E. Lauderburn, B.S., F.E., Forester, Pejepscot Paper Co., Salmon River, New Brunswick.

Mr. Angus McLean, President, Canadian Lumbermen's Association.

Mr. A. C. Manbert, Canadian Lumbermen's Association.

Mr. Wm. McNeill, Managing Director, Timber Industries Council of British Columbia.

Mr. A. W. McCallum, B. Sc.F., M.A., Forest Pathologist, Department of Agriculture.

Mr. C. MacFayden, B. Sc.F., District Forest Inspector, Dominion Forest Service.

Mr. C. H. Morse, B. Sc.F., District Forest Inspector, Dominion Forest Service.

Mr. W. F. Napier, Canadian Lumbermen's Association.

Mr. Frank Newman, B.Sc. F, Superintendent, Ontario Government Nurseries, St. Williams, Ontario.

Mr. R. H. Nisbet, Forester, Price Bros, Limited.

Mr. R. D. Prettie, Superintendent, Forestry Branch, Canadian Pacific Railway.

Mr. Wm. Richards, Canadian Lumbermen's Association.

Mr. Norman M. Ross, B.S.A., B.F., Chief of Tree Planting Division, Dominion Forest Service.

Mr. B. Snowball, Canadian Lumbermen's Association.

Mr. R. C. St. Clair, B.S.F., Assistant Chief Forester, British Columbia.

Lieut.-Colonel H. I. Stevenson, D.S.O., District Forest Inspector, Dominion Forest Service.

J. M. Swaine, Ph.D., Associate Entomologist, Department of Agriculture, Canada.

Mr. L. S. Webb, M.F., Forest Service, New Brunswick.

Brig.-General J. B. White, Canadian Pulp & Paper Association

Dr. E. Voorhis, National Resources Intelligence Branch, Ottawa.

Mr. B. M. Winegar, Assistant General Tie Agent, Canadian Pacific Railway.

Mr. B. L. York, Controller of Timber and Grazing, Department of the Interior, Canada.

Mr. C. C. Young, Manager of Woodlands, Pejepscot Paper Co., Salmon River.

OFFICERS OF THE CONFERENCE.

Chairman—Major-General Lord Lovat, Kt., K.C.M.G., D.S.O., Chairman, Imperial Forestry Commission.

Vice-Chairman—E. H. Finlayson, B.Sc., F., A.M.E.I.C., Acting Director of Forestry, Department of the Interior, Canada.

Secretary—Roland D. Craig, B.S.A., F.E., Forest Resources Specialist, Dominion Forestry Branch, Department of the Interior.

Associate Secretary—Ernest Voorhis, M.A., Ph.D., Research Engineer, Natural Resources Intelligence Branch, Department of the Interior, Ottawa.

OBITUARY.

MR. G. N. SIMEON.

It is with deep regret we have to announce the death of Mr. G. N. Simeon, Deputy Conservator of Forests, Goalpara Forest Division, Assam, as the result of an accident due to derailment of a motor trolley.

Mr. Simeon joined the forest Department in Assam on the 24th December 1910, he joined the army on the 3rd November 1915, reverted to civil employ in December 1919 and up to the time of his death was in charge of the most important Forest Division in Assam. The construction of a tramway to connect the reserves with the Eastern Bengal Railway appealed to his natural aptitude for mechanics and it is sad to think that he has just missed seeing the completion of his work. It was a cruel irony of fate that he should meet his death while using an ingenious motor trolley that he himself had devised and built up in the local repair shops.

The reason for the accident is unknown. Mr. Simeon was driving this motor trolley at a moderate pace across a bridge. The party on the trolley consisted of himself, Mr. W. R. LeG. Jacob, I.F.S, a mechanic and a coolie. On the bridge the derailment took place and the whole party were thrown into the water below. Mr. Simeon apparently fell under the trolley, with his head in the water, from which position he was speedily dragged up on to the bank. The mechanic broke his leg, the rest of the party being more or less unhurt. Eventually, the Civil Surgeon reached him at 4 A.M. next morning and took him straight to hospital in Calcutta, where he died.

He had constantly driven across the same bridge before in perfect safety, and there is nothing to account for the occurrence of this sudden derailment.

Mr. Simeon was an exceedingly capable and efficient officer who never spared himself. He was extremely popular with all his staff as well as with all who met him. Mr. Simeon's death is a great loss to the Forest Department in Assam; he leaves a widow and two small children, to whom the sympathy of all will be extended.

The following appeared in the *Assam Gazette*:—

The Governor-in-Council has heard with deep regret of the death of Mr. G. N. Simeon of the Indian Forest Service, who died on the 27th December as a result of an accident. Mr. Simeon joined the Department in 1910, and during his service in Assam had shown marked ability and enthusiam for his work. He had recently distinguished himself by the perseverance, skill and energy with which he carried out the extension of the Goalpara forest tramway. The tragedy of his death is enhanced by the fact that it was on that tramway that the fatal accident occurred. He will be greatly missed by the Government whom he served, and by his colleagues and many friends in Assam.

REVIEWS AND EXTRACTS.

FOREST INSECTS OF AUSTRALIA.

BY W. W. FROGGATT, F.L.S.

Forestry Commission, New South Wales, Sydney, 1923; pp. i—viii, 1—171, 2 coloured plates, 44 black-and-white plates, 33 text-figures. Price *7s. 6d.*

Mr. W. W. Froggatt, the veteran government entomologist of New South Wales, has produced a very attractive little volume on the forest insects of Australia, which is illustrated with numerous, exceptionally good line-drawings, photogravures, and two coloured plates.

Forest entomology, *per se*, has received little attention in Australia, and no special research on the biology and control of pests has been done. Nevertheless, the author has collected sufficient information on the life-histories and food-plants to form an interesting account of the general conditions under which insect damage occurs to forest trees. The insects are grouped according to their principal hosts. *e.g.*, Eucalypts (chaps. IV—VI) Sugar gum, *kurrajongs*, Wild pomegranate, Wild lime, wattles (chaps. XI—XIV), red cedar, figs, *Casuarinas*, *Banksias*, pine, cypress and *kauri*. On account of the dominance of the two large groups of eucalypts and acacias, and the absence of oaks, chesnuts, poplars, etc., the author considers that the forest insects of Australia differ from those of other portions of the globe, and " in fact, our native trees are more open to attack, because we have no efficient feathered allies, such as the wood-peckers of Europe and America."

It is evident from a perusal of the book that Australian conditions have much in common with those of British India, particularly in the development of the borers of living trees. The *Cossidae*, *Hepialidae*, *Tortricidae*, *Longicornia* and *Curculionidae* have important representatives, among which the giants *Leto staceyi*, and *Zeuzera macleayi* (with wing expanses of 6 and 10 inches) are worthy of note. The ambrosia beetles or shot-hole

and pin-hole borers (*Platypodidae, Scolytidae*) are however relatively unimportant and only one species, *Platypus omnivorus*, is mentioned. Of the borers of stored or unseasoned timber very little appears to be known, and there is a tendency to confuse the work of *Lyctidae*, *Bostrychidae* and *ambrosia* beetles. This has resulted in considerable anxiety over the possibility of introducing borers in timber imported from the Malay Archipelago and the Pacific, and in packing-cases, or tea-chests from India, Japan, etc., or in wooden ventilators used for rice cargoes from Burma.

The author is not always up-to-date in his information on the progress of entomological work outside New South Wales, particularly with regard to timber insects. The account of *Lyctus brunneus* (which is erroneously placed in the *Cioidae*) makes no reference to the work of Altson, Snyder, Kraus and Hopkins. The account of the methods of dealing with white-ants does not teach us much and has nothing more modern than a note in the *Indian Forester* for 1914. On page 21 the author states:- "During last year a committee appointed by the Indian Railway Board made an exhaustive inspection of Australian sleepers on Indian Railways." As far as the reviewer is aware this committee actually published its report in 1911. In dealing with the genus *Hylesinus*, to which the fig-branch borer is incorrectly referred, the author records 13 species on the authority of Chapuis, 1869, being apparently unaware that some 40 species have been described since. In the case of the shoot borer of *Cedrela australis* (*Hypsipyla robusta*) illustrated under the name of *Epicrocis terebrans* Olift in the plate on p. 136, no reference is made to the life-history studies in *toon* published by the reviewer in 1919, *Indian Forest Record*, VII, vii, or to *Queensland Forestry Bulletin*, No. 3, pt. 1, 1917, or *Australian Forestry Journal*, I, 1918, or Tectona, XV, 1922.

Mr. Froggatt does not appear to be very well acquainted with the names of the pioneers in entomology. Thus the altmeister of forest entomology, Ratzeburg, is termed "Ratzenber" on p. 144; Degeer becomes "Dr. Geer" on p. 30 and in the altme ister Geoffroy is "Geoffery"; Herbst is "Herbest" on p. 28 and 2

lines further on Chapuis is "Chapius"; Gemminger and Harold become "Deharold" on p. 24; Chevrolat on p. 26 is "Cheverolet". There are several errors in the scientific names, *e.g.*, "*Tomicus typographagus*" for *Ips typographus* on p. 144.

When dealing with the scale insects or *Coccidae* and the lerp insects or *Psyllidae* Mr. Froggatt is on more familiar ground and his treatment of these groups is authoritative. It is however unfortunate that it has been necessary to describe several new species in a text-book "of value by those interested in Forestry, Architecture, or industries in which wood as a material is employed."

C. F. C. B.

SOWERS AND REAPERS.

A Tale of the Forests.

(*I.—The sowers*).—In all Randungar there was festivity—taluka and town alike. Medars and Sonars, Kunbis and Mahars, all had sunk the antipathies of centuries in a great rejoicing. Goats and fowls were sacrificed, houses and temples festooned, every panther-god in every jungle *khind* was flaming scarlet and the *mowhra* spirit flowed strong and rank, the people's own brand, brewed in the silent ravines. For the impossible had come to pass. The forest staff had been removed, the forest restrictions with them, and the forests themselves were restored to the people.

Not without pains had the feat been accomplished. The mass of privileged prejudice had been hard to move. The people it is true had taken little part in the campaign. They had weakly acquiesced in what they had considered their fate. Petitions they had sent in from time to time, on minor grievances. These had sometimes been removed, the requests sometimes granted other times not. But these things hardly touched the root of the matter. The forests were theirs but they owned them not. This was true. Because Pesterchand Chatterchand Vakil had told them so. He had been telling them for twenty years. And now he had told the Assembly and the Assembly believed him. For who could resist his presentation of the matter?

". . . . . This policy of rapacity is as insidious as it has been continuous. One by one the ancient rights and privileges have been filched from a thrifty and fore-sighted people, whose one fault has been their submissiveness. By slow degrees the absolute rule of a narrow oligarchy has been established, the strangle-knot on the oppressed ryot tightened to its last twist. Where cattle roamed at will is now the obnoxious "closed forest" demarcation and the cattle pounds overflow in every village. No longer may the husbandman build him a roof for his grain shed, still less to shield his family from sun and rain. The revenue and agriculture officers encourage him to double his production of flour, the forest officials deny him the fuel to bake it with. The very fruits of the forest are denied to him. Will he fence his field against wild animals? He must first pay half the value of a possible crop. Will he lop for ash-manure as his fathers did? A thankless task, when wood for the plough and sickle and cart are obtained at the cost of his freedom. The forests have been the ryot's from time immemorial. They are his now but he owns them no longer. For he has been robbed of them by a rapacious department, working for its own glory and profit under the name of forest conservancy. It is for you to restore them now."

Pesterchand has scored and the forests were won back for the people. Hence the festivities in Randungar. To-day his name was on every lip, his praises sung after every leaf-full of *mowhra* spirit. "The forest is ours and now we may live," they shouted.

Only one man was silent and that was Koyaji Bhiku, the Shikari. He had been woodman and cartman, road-maker and fire-tracer in his day, indeed he had followed all the jungle trades and thriven on his wages. But the chase had been his joy and pride and though his step was slow and a bear-clawed shoulder had maimed his upright gait, his eye was clear and his voice steady. He was a great teller of sporting yarns and he would warm to his tale over a bottle of *mowhra* in the weekly market place of the little town. To-day he took no part in the rejoicings. He chewed his tobacco and spoke not. But in so gay a gathering

so crouse a crony was not to be permitted to remain silent and the Kunbis and Mahars rallied him on his glum appearance in the midst of the general gaiety. Then he rolled the leaf in his cheek and spat with zest and they knew he was going to deliver himself and stood round and listened. He did not declaim but he slowly traced the pug of an enormous tiger on the soft dust with his palm and fingers while his furrowed forehead told of the inner searching of his brain and then he quietly spoke :—" I like this not. Good may come but it will not last. I knew a forest saheb long ago. He beat me for lighting the forest on a windy night when I was a *mukadam* of fire-tracers. But when I was mauled by the bear on Jamniabari and lay by for three moons and Jiwanji Makanji sued me for my rent he paid up and I was free to hunt with him again. Many a time we lay among the bracken listening for the sound of the bison crunching the sweet young shoots of the bamboo, and then he would talk. He was none of your baboos and he would take two Brahmin Rangers separately of a morning's outing and walk them till they said the Prant was inspecting the treasury and they must go and show their balances. Well, we would sit and he would tell me things. They were not things of a day or a month or yet of a year, but concerned generations and centuries and aeons. I am old and cannot remember. It will see me out and may be my sons, but the division saheb was wise and he said, 'you cannot eat your nagli cake and have it too.' So go on with your dancing."

A time of unparalleled prosperity and contentment followed the consumption of Pesterchand's political activities. The *ryot* waxed fat. His cattle multiplied for could he not now let them graze at will, without fee and even among the young plantations of *sissoo*, whose tender leaves after the hot-weather showers were green when grass was dry and stale? And why cut the *dhaura* trees flush with the ground when you wanted an axle for a broken-down cart? True, no coppice-shoot would come up to replace the tree when you had hacked it over breast-high but that was the easy way and saved your back and there are thousands of *dhaura* trees in the forest. The same with *dhamni* poles and yokes and *tiwas* for shafts and cart frames. There was a great bother before

about these. Not only had you to get a written permit before you could cut even one, you must trim the stump and use all the wood of one tree before you might have another. What nonsense! As if there were not a lakh of acres of *gairan* in Randungar alone. Then there were the fencing stakes. It is true the Commissioner sahebs over-ruled the jungle sahebs because their pay was bigger and there was always the chance of becoming a Member and wild pigs are a sure draw with committees who come round and get *bhatta* and are called Rao Bahadur, and so you were given even the fencing stakes free. But what restrictions! It was not worth while to have them. You had to send in lists of areas you would fence to the Mamlatdar, and even then you were not allowed to use the stakes for fuel or for *rab* on seed-beds, but were told to make them last two seasons and collect cowdung and dead-wood to burn. And after all you might not have teak and forbidden species because they were wanted for house-building and revenue, as if there were any limit to what the forest will produce! Now you may for fencing cut over the five-year-old teak coppice without let or hindrance, and when that is used up there is always the *ain* and *nana*.

Then there was the lopping of branches for ash-manure called *rab*. Was ever so silly a fuss made over so simple a matter, ever a privilege so ringed with needless restrictions? You might not lop the same trees two years running. You must not lop the top off the tree least it cease growing. Of course, if you got a forest officer on the quiet even he would admit that cutting the top off a tree actually increased the growth of side branches. But catch him admit it on paper. Again cutting *tahal* from young and hopeful saplings was anathema. Did not a certain collector come out and lecture the admiring crowds as follows? "A dog has six pups. They all drink the milk. Therefore no pup grows big. What do you do? You kill five pups. What happens? The remaining pup drinks all the milk. It therefore grows large. So it is with the six coppice shoots from one stump. You may cut five but keep one, it will then grow to a tree." True, as Deoji Kalu pointed out when the collector had gone, you might as well

say, cut off all the hairs on a man's head but one, it will then grow as thick as your leg. But nobody grudged the Collector Saheb his metaphor. After all he must be right for he is paid to do no wrong. What the Sarkar says is true. That was in the old days. Now it has been exposed. You may lop as you like. Spoil the trees for timber? Maybe, but there is plenty at the back of the hill. Then the everlasting bug-bear of fire protection. Refined *zulum*, run riot. In the last century fires were practically unchecked, everything was burnt over every year. Not only did the forest remain but firing benefited the ryot. Each hot weather saw the hills adjoining fields covered with a wood-ash. The rains washed it down and fertilised the fields Fire-protection stopped these advantages and oppressed the cultivator. But now it was all right. The supply of wood-ash was renewed. New grass would come up early with the first showers and the cattle would flourish. Another scandal had been exposed. Strict conservancy was squeezing the ryot out. The forest encroached more and more on the cultivator and he might not clear it back. Pig and other noxious animals preyed on the crops, tiger and panther on the cattle. The concession of clearing wide strips round cultivation of undergrowth had been useless because timber trees might not be cut too. The forests were the cause of the malaria fiend which stalked unchecked. Pesterchand had changed all this. The villagers could unite to clear all tree growth within a mile of habitation and they eagerly began to do so. The fine teak pole belt round Palaskhond a long narrow strip cultivation containing two huts, was soon cut down and the timber used for grain-stores, look-out machans and cattle-sheds, and new cultivators poured in to take up the long-deserted lands.

And so with the wild fruit trees. Kalu Patil knew all along that if you girdled them with an axe you increased production by a hundred per cent. (for that year). He proceeded to practice, with the co-operation of all, and with the result that a good trade with Randungar town was established and the cash emoluments of the lesser villages went up with little effort on the part of the producers.

A time-honoured practice revived, long fallen into disuse through the obstruction of theorising forest officers. This was the lucrative practice of shifting cultivation in the forests after burning. Why restrict field crops to flat soil which require constant manuring from outside, entailing severe labour for mediocre result? Let nature yield her unstinted abundance. Cut, burn, throw seed in the ashes, sit and smoke and reap a rich harvest. Next year go but a little way further up the slope and do the same. By the time you have got further into the hills than you care to climb you can begin again on the regrowth from the first year's clearance.

And so it went on. Rents were paid with ease. *Sowkars* were even paid off their debts of a former generation, capital and compound interest. Staggered by such unwonted treatment they retired from the scene and left a contented loyal rural population to deal direct with their original landlord, Government. Peace and plenty reigned. Floreat Pesterchand!

But Koyaji Shikari sat and smoked, and was silent. Aged and bent, he no longer took part in the hunting. Shikar was free to all, so why should he trouble? There was no glory left in it, no saheb to lure to tiger, panther, bison, bear. Only now and then he would lift his head as his fat son strolled in from the Randungar market and would murmur "I like it not. The Saheb told me things. They were not of a day or a month or yet of year. Good has come but it will not last." And no one heeded him.—[*Times of India*.]

PYINKADO.

A Supreme Wear-resisting Wood.

The artist or the craftsman who believes in himself must see to it that the material in which he works is the most suitable for his purpose. It may be fitting that American machinery should be made to last but a short time on the grounds that it will be superseded by a better design before its life has ended. It is not so with the artist, like Stradivarius as sketched by George Eliot.

"I say, not God Himself can make man's best
Without best man to help Him. I am one best
Here in Cremona, using sunlight well
To fashion finest maple till it serves
More cunningly than throats for harmony."
We picture
"That plain white-aproned man who stood at work
Patient and accurate till four-score years
And for my fame, when any master holds
'Twixt chin and hand a violin of mine,
He will be glad that Stradivari lived,
Made violins, and made them of the best"

The artist, who is careless of his pigments may in his own life-time see his picture fade. The architect who chooses his stone amiss—or his successor—may find his building crumbling under the influence of a city's smoke. So, unavoidably, and with no reproach of carelessness on the part of the artist, we find at a long last the beautiful timber roof of Westminster Hall attacked by the anobiid beetle (*Xestobium tessallatum*), and now made durable with steel.

It is regrettable perhaps that the great work of the artists of a by-gone age should now be made in some sense a sham. Purporting to be wood, it now largely depends on metal, and is no longer the *bonâ fide* sincerity its creators built They had at their disposal the best of English oak; we can imagine with what care they searched for the best that Nature had produced in these islands.

We may read in the Records of how "John Godeney, Clerk of the Works, is appointed to take by land and set all the King's timber in the wood of Pettlewode in the County of Sussex to the Port of London for the King's works within the Palace of Westminster."

So, too, with the beautiful 16th century roof of the Middle Temple, the Hall of which has been the scene of many historic incidents since Queen Elizabeth was entertained there after the completion of the ten years' labour by which it had been built

Now this same destructive beetle has attacked the oak roof, which will in all probability have the same strengthening of metal to keep it intact.

The artists who created these works considered that in British oak they had the best material possible. They knew nothing in those days of the wonderful products fashioned in Nature's workshop in other lands. To them the forests of India and Burma were unknown. Though philology has proved that the precious cargoes of King Solomon's merchant ships came from the ancient coast of Malabar; though the brilliant mediæval republic of Italy drew no small share of their wealth from their Indian trade, and though it was the hope of participating in this trade that stipulated Columbus to the discovery of America and Vasco da Gama to the circumnavigation of the Cape of Good Hope, yet the temptations which allured these adventurers from Europe to the East lay rather in the jewels and gold and silver; in the fabrics of silk and cotton; and in the spices and drugs, rather than in the valuable timbers which were to be found in the dense virgin forests which clothed the hills and valleys. Not till within the last year or two have these become part of the trade of the East with Europe.

Amongst these timbers is one which in Burma is second only in reputation to teak, and this is the *pyinkado*, or iron-wood, of Burma. It is found throughout the greater part of that province but is probably most abundant as well as most accessible in the forests of the Pegu Yoma, the low range of hills running up the middle of Burma, and forming the water-shed between the Irrawaddy and the Sittang rivers. Here this great tree, with its fragrant flowers, grows to a height of 120 feet with a girth of 12 feet or more. The wood, reddish-brown in colour, is hard, tough, strong and rigid, and of a durability that is possibly unsurpassed by any other timber in the world; in addition, it is not subject to the attack of the beetle which has destroyed the oak in the Westminster Hall. That a wood should exist which was heavier than water, more indestructible than iron, more durable than teak, would, we may conjecture, have been of the greatest interest to

those who wrought those timbered roofs centuries ago. Less than three hundred years from its erection the roof of Westminster Hall had begun to need repair. How long might it have lasted had *pyinkado* been used, a wood of whose compass we can conceive not in centuries, but almost millenniums ?

This timber is now actually on the market, and almost illimitable supplies are forthcoming from Burma ; they are available in lengths and sizes suitable for every purpose for which the wood can be employed. Three hundred years ago a national product was deemed the most suitable for such work as these roofs; as the nation has expanded, so has its needs, and as the Empire has grown, so also has the store-house of natural wealth, so that if the artist is to choose the best material possible for his work, might he not with as much appropriateness choose *pyinkado* to-day, and thus still give preference to a product of the British Empire.

Another interesting use for which *pyinkado* could supersede oak is for timbers upon which are hung the bells in a belfry. The belfry was originally constructed expressly for the bells, in order to save church towers from injury through the vibration of enormous masses of resonant metal ; the derivation of the word "bergen," to protect, and "frida," safety or peace, shows this plainly. Belfries were once perhaps of more practical use than they are now, for the bells summoned soldiers to arms as well as Christians to church, and sounded the alarm in fire or tumult. They have rung alike over slaughtered and ransomed cities, and far and wide throughout Europe in the hour of victory or irreparable loss. The subject is a fascinating one. The bells themselves are the life of these old church towers, and they are often of great value, richly, decorated and inscribed. Their weight is often considerable ; the great bell at Moscow was said to weigh 198 tons. The largest whole and hung bell in the world is said to be the bell in the Buddhist Pagoda at Mingun in Burma, which was cast by King Bodaw Paya, in the 18th century, it weighs 90 tons It is obvious that the timber upon which the great bells hang must be exceedingly strong and durable. Father Le Comte, a Jesuit missionary, wrote of seven

enormous bells at Pekin which proved too heavy for the Chinese tower, and one day they rang it into ruins. The bells in the Westminster Clock Tower are swung from an iron framework, but these columns and girders lack the particular dignity which belongs to the rafters of the more ancient towers, and timber will probably continue to be used for this purpose. Oak has for centuries been the only wood employed, but the heaviness, the strength and the durability of *pyinkado* may well recommend it for the future

Indeed, the uses of a timber with the peculiar qualities of *pyinkado* are almost too numerous to catalogue. It can supplement greenheart for piles and dock work, and teak for ship building. It can be used, as the Madras Government use it, for gun-carriages ; it is suitable for railway wagons, for paving blocks and for all kinds of building and constructional work, and it may well be described as the supreme wear-resisting wood.—[*The Timber Trades Journal, Vol. XCIV, No.* 2456.]

GERMANY'S BLACK FORESTS.

Seven hundred years ago the area of Black Forest of Germany formed part of the large estates of one of the Counts of Eberstein, concerning which gentleman nothing more descriptive can be said than that he was a typical and inveterate crusader. Time after time, he rallied his retainers about the ancestral banner to set out for Palestine, and as often returned home with only a ragged remnant of his band.

Each expedition left him poorer, and finally to meet the cost of a last effort, he mortgaged to a group of thrifty woodsmen the best portion of his forest domain. History relates that the poor Count was finally killed by the Turks, and as he left no heir, his property fell to the State. The ruler of Baden subsequently tried his best to break the mortgage lien title of the woodsmen, but his efforts were of no avail, and the forest remains to this day in their successors' hands.

These men who supplied the money for the Count to spend were known as rafters, because they put together great rafts of the largest fir timbers and floated them down the Murg, the Neckar, and the Rhine to sell in Holland, where the requirements of ship-building brought good prices. This was centuries before the first idea of forest conservation had occurred to anybody, but as there was no market for anything but the largest trees, which were also accessible to the streams, the forest was not ruined.

So grew up one of the world's earliest corporations and without doubt the first commercially productive private forest which has had an uninterrupted producing record up to the present day. The ownership has remained in the hands of the descendants of those rafters, most of whom have become wealthy families and now control not only that identical forest, but as individuals and members of other companies, own and operate some of the finest saw mills, paper mills, and other wood using concerns of Germany.

The forest comprises about 12,000 acres of land similar to the Adirondack mountain region, said to be worth in the neighbourhood of $300 an acre, and there is probably almost as much timber growing on the land to-day as there was 700 years ago.

An inventory is taken of the forest every two years and the consumption of timber regulated. The amount of timber in the Black Forest is a fixed quantity and does not increase or diminish. In 50 years there will be no more or less timber in south Germany than to-day. Quite a lesson for business men over here who are paying thousands of dollars in freight bills or lumber because there are millions of acres of idle land fit for nothing but growing trees.—[*Illustrated Canadian Forestry Magazine, April 1923.*]

CORRESPONDENCE.

POPLAR AVENUE ON THE MOTOR ROAD FROM RAWALPINDI TO KASHMIR.

SIR,—In the November issue of the *Indian Forester*, Mr. Gamble refers to the 'wonderful' poplar avenue on the motor road from Rawalpindi to Kashmir and thinks that this poplar must be the fastigiate form of *Populus alba*, and cannot be the "Lombardy Poplar" which all the books mention as being planted in avenues in Kashmir.

Mr. Gamble is being supplied with specimens of leaves of this poplar to ensure accurate and final identification but, to my mind, there is little doubt that it is "Lombardy Poplar," *Populus nigra*, Linn., and not *P. alba*, Linn. Both of these species occur in Kashmir and there can be no mistaking of one from the other. The former is known as *faras*, and the latter as *wan-faras*, or *jangli safeda*. The leaves of the latter are deeply lobed, possess 5 basal nerves, and the petioles and under side of leaf are densely clothed with white tomentum. The leaves of the former—the avenue poplar—however, are not lobed, are distinctly smaller in size, almost triangular in shape, acuminate, crenate, possess three basal nerves only and are glabrous. In addition to these varieties, *P. Ciliata*, Wall., also occurs sporadically in the forests of Kashmir, but it is the "Lombardy Poplar" (*P. nigra*) which is the favourite avenue tree in Kashmir, and which with *chenar* (*Plantanus orientalis*) lends a characteristic picturesqueness to the charming valley of Kashmir.

This poplar avenue begins from Baramulla, the gate of the Happy Valley and runs uninterruptedly to Nishat and Shalimar, the famous Mogul gardens in Kashmir—a distance of about 40 miles. Without fear of exaggeration it can be said that this road is one of the best in India, and it is this bewitching avenue which is the first to captivate the imagination of a visitor on his entrance into the valley and which keeps him spell bound until

he makes his exit. These tall poplars tower up straight into the skies, in stately grandeur, and guard the road on both sides, very much like an army of disciplined soldiers standing erect in a most beautiful formation.

This avenue was planted about 30—35 years back when Bakhshi Parma Nand of Sagri, Rawalpindi, was the Governor of Kashmir and who is otherwise well-known for successfully averting a famine crisis which unfortunately recurs periodically in Kashmir.

The poplar trees are espaced about 2′—4′ apart and as they are so near, they naturally prune themselves of their lower branches. The boles of the trees are, therefore, characteristically white and clean. The crown expands slightly at the top but never sufficiently to give the tree anything but cupressiform appearance. The poplar grows exceedingly fast, being next only to willows in this respect, to which it resembles in its capacity to sprout forth from cut branches, partly buried in earth. It is, however, much preferred than the latter, because its wood is more valuable and saleable as timber, being used largely for construction of *larhis* (log huts) of Kashmiris.

The same poplar has been used recently as an avenue tree for several other roads in Kashmir, *e.g.*, that from Baramulla to Sopor (10 miles), Srinagar to Anantnag (34 miles), Handwara to Sopor (10 miles) and that to Tangmarg, Gulmarg (about 15 miles), in which cases it is partly interrupted or mixed with willows. The poplar is exceedingly well suited for this purpose, in Kashmir it is an avenue tree, *par excellence*. It is also very much planted along canals, and around orchards and bungalows. In the latter cases it forms excellent enclosures.

Being a fast grower, its wood is naturally fragile, but the tree is sufficiently hardy to withstand wind and heavy snowfall of Kashmir. The superannuated trees, *i.e.*, those above 5′ in girth, are, however, liable to be attacked by a longicorn which makes big galleries in wood like sal, *Hoplocerambyx*, making the tree unsightly and ultimately causing its death. Of late, the insect attack appears to be spreading, though it is not sufficiently serious at

present. This appears to be very little realised by the State P. W. Department which is in charge of this avenue. It is most necessary that such diseased trees should be removed immediately to prevent any further damage.

The poplar sheds its leaves in autumn. These leaves, as also *chenar* leaves, are eagerly swept from the road by Kashmiri girls as they form an excellent fuel for burning in *kangries*. In winter the branches of the tree are clothed in flakes of snow, and the panoramic view of the road is then, if anything, more splendid than at any other time of the year. In spring, the road is carpeted with white silk which comes from the hairy catkins. In summer, the green foliage effectively fend off the heat rays of the sun and keep the road pleasantly cool.

On the whole, the road is one of the finest in India, if not in the world, and it is well worth a visit.

SHER SINGH, P.F.S.,
Kashmir State.

PRACTICAL METHOD OF MEASURING EARTHWORK ON HILL-SIDES.

SIR,—With reference to the remarks and criticisms on the practical method of measuring earthwork on hill-sides published in the November issue of the *Indian Forester* I am thankful to the Forest Officer who made the useful remarks and criticisms.

The method at first sight does appear to involve difficulties and troubles of the kinds mentioned, but in actual practice it is not so. The convenience and rapidity with which earthwork on hill-sides can be measured by this method are to be found only when one gets used to it.

It is true that a steep side-slope needs longer horizontal and vertical rods, but a low side-slope does not require a longer horizontal rod. The lower the side-slope is, the shorter the horizontal and vertical rods it requires. The horizontal rod need not be longer than half the total width of the cutting. Our rods are in no case wider than 12 feet. To obtain a 12 feet wide road the cutting on hill-sides need not be wider than 8 feet. The

remaining 4 feet is formed by the made earth obtained from the cutting. Thus making allowance for a sloped back of 4 feet a horizontal rod need not be longer than 8 feet. The vertical rod also may be of the same length as one cannot measure conveniently a height above 7 feet. Here it may be mentioned that the spirit level need not always be held on top of the horizontal rod. For convenient reading it can be held beneath the rod when the height to be measured is higher than the height of the eyes of the man engaged in measuring. In the same way the spirit level may be placed on its back or on its side for convenient reading according to the height to be measured. It is convenient to have one inch square rods.

There is no trouble at all in measuring the height by fractions when the slope is too steep for a single reading, in practice it will be found that no slope will be too steep to require more than two readings.

Regarding the table for height of cutting and sloped back it may be altered according to requirement. For the common hill soil in this Division it is found suitable. A back slope of 45 degrees is unnecessary for ordinary soil.

HATIM TAI, P.F.S.

THE EASTERN LIMIT OF THE NATURAL DISTRIBUTION OF DEODAR.

SIR,—I believe it is an accepted fact that indigenous deodar forests do not occur east of the Niti pass. Brandis lays down this limit and ascribes the existence of a few deodar groves in the Almora district to planting. It may conceivably interest a few of your readers to learn that, although indigenous deodar forests do not occur in the Kali Valley, yet at the head of the Kurnauli Valley in Nepal there exist great deodar forests hitherto unworked and unexplored. The reason for a 200 miles gap between the forests of the Niti pass and these Kurnauli forests

will be found difficult to explain, but I feel confident that our *pandits* will be able to do so.

The Kurnauli is the river which eventually, after junction with the Kali, becomes the Gogra.

J. V. COLLIER, I.F.S.

THE LATE MR. G. N. SIMEON, I.F.S.

SIR,—There are probably some of your readers who knew Mr. Simeon and would perhaps like to send a cheque to help Mrs. Simeon who is left very badly off as she has two small children to support.

I am arranging to raise a collection on her behalf and any money sent to me will be duly forwarded tot her.

F. TRAFFORD, I F.S.,
Conservator of Forests, Assam.

1. Jetties at Haiphong.

2. Archway near East Gate, Peking.

3. Temple courtyard, Peking.

4. Roadside eating-stalls, Peking.

Photos by W. A. Robertson, I.F.S.

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MORE RANDOM NOTES FROM EASTWARDS ROUND.

[CONTINUED FROM "INDIAN FORESTER," XLIX, JULY 1923, pp. 335—342.]

Our next port of call was Haiphong and I have always regretted that we had to make the trip by sea, for everyone agreed that the land route along the coast of Annam is one of the finest in the world. Unfortunately the road along which we went in our last forest trip from Saigon has not yet been carried right through to Hanoi, though a few years will see it completed.

Our stay at Haiphong was too short to allow us to get out to the Bay of Along, which from its pictures looks as if the most fantastic of Chinese artists had been allowed to fashion an archipelago after his own designs, so we had to content ourselves with a glance at the town, which struck me as the most official looking of any I have seen anywhere. Haiphong has one point in its favour; coaling ship there is the cleanest operation in that line that I have seen and a very pleasant surprise after most Eastern ports.

The remainder of the trip to Shanghai was not particularly interesting except that the scenery along the northern approach to Hong Kong harbour gave one a foretaste of the extraordinary charm of the scenery in China.

It may be as well to warn any foresters who propose to go up the China coast in February to be prepared for cold. From Haiphong onwards it got steadily colder, till by the time we were anchored off the mouth of the river waiting to go up to Shanghai, I should not have been in the least surprised to hear

that there were icebergs about. Shanghai is said to possess the longest bar in the world, which may be so though I did not have the chance of seeing it, but I can guarantee that it also provides the most searching brand of damp cold to be found anywhere outside the British Isles.

In fact my recollections of Shanghai are not particularly happy, more especially as my companion elected to go down with enteric at this point. Between the disgusting cold and the business of getting him into a nursing home, I had not much chance of enjoying the beauties of the place and I was not sorry to start off to Peking. I regret to have to confess that I "did" Nanking is true globe-trotter style, but I enjoyed it, in particular my introduction to the North China, urchin, a most engaging specimen of miniature brigand, whose comical appearance in his wadded coats and irresistible grin compel one to give him something. A swarm of them beset me as I entered the Ming Tombs and pursued me round much of the way and I realised that sooner or later I should have to give in, but managed to hold out until I got out again, when I jumped into the carriage pressed some assorted coppers into the hands of the smallest and cheeriest of the gang and told the driver to go like blazes while an immense wail went up from the disappointed.

This day also taught me that a wise man will take the same view of Chinese money that the Saxons took of arithmetic before the Conquest, namely, that it is beyond the power of the human mind to deal with, and will simply take thankfully what the bank is pleased to give him, or any one else for that matter. One may assume that perhaps the shroff of the bank knows exactly what happens when a misguided individual in Shanghai asks for Peking notes against his letter of credit, but I do not suppose that anyone else can except the worthy in the A.G's. office who cooks up our leave salary bills. I dimly apprehend that you take sterling and turn it into taels, which brand I never made out, and turn them into dollars and discount them again for the Peking brand of the latter, but beyond leaving with the conviction that I had always got less than my due, my transactions with the banks are swathed in mystery to me. When you come to

calculating how much change in "small money" you should get for a payment in "big money" at any particular place, the definitions of the Athanasian Creed are lucid compared to those of the local value of the dollar. The nett result is that you receive an assortment of picturesque coins hailing from places you never heard of and a large percentage of them will turn out not to be current in the next town, if not in the next shop. They say there are three million money barbers of sorts in China. I wonder there are not more for it must be a paying game when you understand it. On the other hand learning it is expensive.

Before starting for Nanking, there was news of a big railway strike at Hankow and there was some uncertainty that the Nanking-Pukow ferry would run in connection with the trains, so I was advised to take the lower ferry which was not likely to be affected by the strike, which I did although I had some doubts about getting my baggage across seeing that I could not speak a word of Chinese.

The launch was packed with people and towed alongside a flat even more densely crowded. Halfway across the launch stopped and began to drift down stream, while there appeared to be a certain amount of commotion amongst the crew. I began to wonder whether the strike had come down to Nanking and whether the crew had seized this opportunity to make a start. For several minutes I must confess that I felt quite uncomfortable, for I did not at all fancy finding myself on the beach of the Yangtse several miles below Nanking not knowing a word of the language, even though I knew that foreigners are usually left out of any domestic rows in China. However it turned out that they were merely stopping to cast off the flat from alongside and tow it astern, so with some relief I turned to a Chinese schoolboy who was sitting next me and had been trying to attract my attention to his school-books. One of them was a sort of spelling-book with the picture of an object on one side and a character on the other. It occurred to me that some words in Shan are the same as in some dialects of Chinese and that I would see whether he would recognise them. The result was most successful and we mutually beamed with smiles while

the crowd round us which had grown much denser during the experiment beamed in sympathy. In return I had to demonstrate the working of my camera and arriving at the shore we broke up with much smiles and hand-shaking. Incidentally neither o us could speak a word of the others language. Landing on to the pontoon was a splendid scrimmage, oncomers and offgoers charged each other blindly, and I had occasion to save a small girl from a very chilly bath in the river. The confusion was increased by a party of soldiers escorting a very frightened looking individual on the ferry, and for a time I thought that several people were bound to be pushed into the river, but we all managed to get off in the end. I should have liked to have found out who the frightened escorted one was, whether he was merely some successful official with his usual escort, or one who had backed a loser in the political game and was off to pay for his bad judgment against a wall.

My prudence in taking the other ferry was rewarded with a couple of hours' wait on an icy platform scourged by a piercing wind followed by a further wait in an unheated train until the train ferry eventually did arrive, which resulted in my getting the finest chill in my life. Moral : never be prudent again.

If my recollections of Shanghai are cold and unhappy those of Peking are cold and of the happiest, but where the cold of Shanghai was damp and penetrating that of Peking was bone-dry and bracing, only when the wind blew in off the desert, fur caps fur gloves and ear-muffs seemed most desirable for at times it felt as if one's face was being rubbed with sandpaper.

Of all the towns that I know in the East, Peking is the most interesting and the most fascinating. To look at it is not striking for there are no very conspicuous buildings but it contains a host of delightful glimpses and it is a joy to walk about and see the life on the streets. There is no need for me to describe the place, any guide-book will do that with much greater accuracy. What pleased me was to go to places which the guide-book does not mention, to which my hosts, the kindest of people, took me.

Single-handed I went only to the Great Wall and the Ming Tombs. The only thing to be said about the first is that it makes

you feel microscopic, and the second led me to make myself guilty of the crime of breaking into a tomb. Under old Chinese law the penalty is probably slow and painful, I imagine, but I gather that the offence is not extraditable.

From Nankow I set out on a rather diminutive donkey driven by a cheerful looking boy and we proceeded for a number of miles over dry stony country, where the roads were mere ribbons of loose pebbles crossed by frozen streams, urged on by the donkey-boy's dreary repetition of "*Tak Oi*" which had about as much effect on the donkey as the abbess mystic words had on the mule in Tristram Shandy. After twelve miles of rather dreary country only enlivened by three hamlets, innumerable magpies and a few clumps of stunted pines growing exactly as the Chinese artists depict them, we got to the big gateway at the end of the Sacred Road leading to the tombs. There I got off, being too cramped with sitting on the saddle, for it seems to me that you need to be as tough as the Chinese to have any comfort on their saddles, and walked ahead down the avenue of strange stone beasts. No doubt it would be prettier in spring, but there was something very impressive in the open dry plain and dusty wind whirling about the monuments. "So much the wind has borne away."

I soon lost sight of the donkey and, of course, when I got near the tombs, took the wrong turning and landed up at a smaller tomb about a mile off my course, but managed to get to Yung Lo's tomb at the same time as the donkey-boy. Then there was a hitch. There ought to have been a caretaker to show us in, but the huge door was shut and no one was about. The donkey-boy yelled and nothing happened, I bellowed and nothing happened, then a pedlar turned up from nowhere who had business with the caretaker and he yelled and nothing happened, finally we all yelled and hammered on the door with the same result.

The donkey-boy and the pedlar held a long talk, the gist of which was, I gathered from signs, that the caretaker was up at another tomb, and that the pedlar would go there and send him down. So he left us gazing furiously at the gate, for to my

reckoning after he had got to the other tomb, finished his business with the caretaker and the latter had got down to us, it would be night for it was then getting on for four o'clock.

At length, peering in despair through the cracks of the gate to try and see something of the interior, I noticed that the gate was shut only by means of a heavyish strut propped against it, and it struck me that as the caretaker would obviously not have climbed over a twenty foot wall after closing the gate there must be some other way of getting through the gate itself. After a search I found a loose plank rather cunningly fastened with a bent nail, which I promply took out, reached in and pushed down the strut. The look of delighted admiration which I caught on the donkey-boy's face as I did this was worth having lived to receive. It was the unstinted tribute from a master of mischief to one whom he considered to be a super-maestro in his own line of business. We then entered in triumph.

On the way out we met the caretaker into whose hands I promptly thrust the official fee, not that I bore him any gratitude but because having once pocketed it he had condoned the offence, and I could then majestically wave away his clamour for more, and make a dignified retreat.

The road home was rather a *via dolorosa*. It got steadily colder and darker, while gritty whirls of dust and snow blew up off the plain. In fact we should have made an excellent study for a romantic picture of "Lost in the Gobi." The cries of "*Tak Oi*" dwindled to silence and the donkey-boy fell back on his next line of offence, which consisted in prodding with the butt of his whip the portions of the donkey most accessible from astern. Later I discovered that the butt was spiked. In this way the donkey's pace was certainly improved, but when the most vulnerable spot was goaded there resulted a series of epileptic bounds which nearly maddened the rider. A Chinese donkey-saddle in those parts is a flat circular platform covered with a rug and furnished with very short stirrups. When one's feet have lost all feeling and one is stiff with cold and aching from the cramped position, to be bumped like a pea on a grid goads

one to murder. I very nearly got off to slay the donkey-boy but had to stay my hand. If the donkey-boy were dead or fled, how was I to get back? To sit facing the tail and prod the donkey would be ignominious in position and undignified in action. To follow the road on foot through the boulders was to invite a sprained ankle, and I have never understood how the donkey got along. To strike across unknown country in starless darkness with the chance of hitting a thin patch of ice on one of the rivers seemed to be merely foolhardy, so there was nothing for it but to stick by the donkey-boy.

Well, after dark when we seemed to have been travelling many hours, we met the first folk whom we had struck on the return journey, who turned out to be a search party sent out from the railway-hotel, and shortly after it was intimated to me that the donkey-boy would leave us and the necessary tip would be acceptable. He was welcome to it for he was a cheerful rogue and had had a weary trudge of it.

Even after we got to within sight of the lights of the town it seemed an endless time before we got to the hotel after threading our way over railway-tracks and round caravan-inns. I must confess that by the time we got to the hotel I had lost all interest in everything but, arrived there, and after something to warm me up, I felt that the day could best be summed up in the words of an old and exceedingly disreputable acquaintance of a friend of mine, who once remarked, "Yes, Mr. ————, its been the hell of a life but, mind you, I wouldn't have have missed it for anything." Nor would I.

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NOTE ON THE STRENGTH, TREATMENT AND DURABILITY OF SAIN (*TERMINALIA TOMENTOSA*) SLEEPERS.

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PART I.

A BRIEF REPORT ON THE STRENGTH CHARACTERISTICS OF *TERMINALIA TOMENTOSA* AND THEIR BEARING ON ITS PROBABLE USEFULNESS FOR RAILWAY SLEEPERS.

This report relates to the first series of tests undertaken under Project No. 4, "Mechanical Strength, Seasoning Properties, Treatment of and Key to certain Indian Sleeper-woods."

The object of this part of the work is to obtain data on the strength, elasticity and spike-holding power of the wood, and for this purpose two lines of investigation are followed. First, information is collected on the strength and elasticity of the wood, and second, tests are made of the stress necessary to withdraw standard railway dog-spikes when driven into pre-bored holes of various diameters.

In collecting strength data, if a timber to be studied in this investigation has already been subjected to the standard routine tests this information, which is full, reliable, and final is used. If such data be not available a number of similar tests are made and the results tabulated. This, though not final, is sufficient to give a really good indication of the probable fitness so far as strength is concerned of the wood for use as sleepers. Fortunately in the case of *Terminalia tomentosa* (Ver. *sain*, *matti*, *asna* or *taukkyan*), the results of routine tests are available.

In the tests of spike-holding power ordinary dog-spikes are driven into pre-bored holes of $\frac{3}{8}''$, $\frac{1}{2}''$ and $\frac{5}{8}''$ diameter, and then withdrawn in the testing machine, measuring for each increment of withdrawing stress the amount by which the spike has been

GREEN TIMBER.

	SPECIES	LOCALITY	SEASONING	SP. GR. (OVEN DRY)	MOISTURE CONTENT	WT. PER CU. FT. IN lbs.	SHRINKAGE RADIAL	SHRINKAGE TANGL.	STATIC BENDING F.S. AT E.L.	STATIC BENDING M. OF R.	STATIC BENDING M. OF E. IN 1000 lbs/sq. in.	STATIC BENDING WORK TO E.L.	IMPACT BENDING F.S. AT E.L.	IMPACT BENDING HAM. DROP	IMPACT BENDING M. OF E. in 1000 lbs/sq. in.	IMPACT BENDING WORK TO E.L.	COMPRESSION PARALLEL TO GRAIN F.S. AT E.L.	COMPRESSION PARALLEL TO GRAIN MAX. C.S.	COMPRESSION PARALLEL TO GRAIN M. OF E. IN 1000 lbs/sq. in.	COMPRESSION PERPENDICULAR TO GRAIN F.S. AT E.L.	HARDNESS RADIAL	HARDNESS TANGENTIAL	HARDNESS END	SHEAR RADIAL	SHEAR TANGENTIAL	TENSION RADIAL	TENSION TANGENTIAL
	TECTONA GRANDIS (TEAK)	BURMA	GREEN	0·591	49·9%	55	2·1%	3·3%	6935	11460	1640	1·65	17040	36"	2070	7·83	3815	5710	1735	930	980	960	910	990	1080	515	685
	" " "	MALABAR	"	0·614	74·0%	67	2·5%	5·8%	6650	10770	1568	1·60	15385	32"	2174	6·11	3840	5470	2139	1160	1145	1135	965	1130	1315	780	925
	" " "	C.P.	"	0·526	69·2%	55	2·2%	3·6%	5635	9085	1207	1·50	13225	28"	1609	6·02	3430	4480	1534	1005	835	870	820	955	1205	705	805
*	" " "	BURMA	GIRDLED	0·593	32·5%	49	2·2%	3·4%	7690	12080	1810	1·84	17815	37"	2305	7·75	4575	6425	1938	1080	1010	995	875	1025	1110	270	475
	TERMINALIA TOMENTOSA (SAIN)	U.P.	GREEN	0·707	53·5%	68	4·8%	7·1%	6895	11290	1662	1·62	17725	39"	2299	7·85	3890	5590	1984	1170	1540	1470	1450	1070	1385	525	630
	DIPTEROCARPUS ALATUS (KANYIN)	BURMA	"	0·574	73·4%	62	3·6%	8·6%	5345	9410	1478	1·10	15220	29"	2109	6·30	2435	4530	1596	760	910	865	885	955	1070	720	1060
	" TURBINATUS (GURJUN)	"	"	0·655	65·7%	68	4·2%	8·9%	6935	11020	2020	1·35	18660	32"	2698	7·21	3890	5865	2272	950	1020	1010	1060	885	1055	740	885
	" TUBERCULATUS (IN)	"	"	0·726	50·3%	68	4·4%	9·1%	6990	11595	1754	1·57	20110	40"	2681	8·59	3670	5640	2023	1220	1420	1420	1455	1195	1345	590	955
	CEDRUS DEODARA (DEODAR)	PUNJAB	"	0·468	44·7%	42	3·6%	5·2%	5145	8670	1348	1·12	12100	20"	1436	5·67	3035	4445	1413	665	555	585	725	810	1015	235	355
	ANOGEISSUS LATIFOLIA (BAKLI)	U.P.	"	0·757	38·8%	66	3·9%	7·3%	5960	11445	1501	1·39	17945	56"	1947	8·81	2680	5170	1674	1175	1630	1605	1670	1380	1495	625	935
	ARTOCARPUS HIRSUTA (HEBALSU)	MADRAS	"	0·516	79·6%	38			6865	10690	1487	1·80	14480	30"	2047	5·85	4250	5890	1344	825	970	1035	1060	1030	875	510	560
	SHOREA ROBUSTA (SAL)	C.P.	"	0·684	60·1%	68			7460	11985	1802	1·74	18170	40"	2587	7·21	4825	6020	1778	1135	1355	1335	1240	1135	1300	680	965
	" " "	BENGAL	"	0·745	51·7%	70			8195	13960	2135	1·79	20615	45"	2651	8·98	5345	7025	1951	1480	1640	1680	1445	1335	1310	800	1075
	" " "	U.P.	"	0·714	56·8%	70			8070	13400	1918	1·92	18580	34"	2409	8·09	4915	6810	2383	1585	1495	1560	1445	1430	1535	570	855

AIR DRIED TIMBER

	TECTONA GRANDIS (TEAK)	BURMA	AIR DRY	0·568	14·1%	40	—	—	9425	14465	1830	2·73	20310	31"	2521	8·67	5385	8350	2011	1280	960	990	860	895	1390	505	570
	" " "	MALABAR	"	0·605	13·7%	43	—	—	8910	12300	1710	2·63	14620	22"	2130	5·80	5440	6830	2210	1490	1130	1175	1070	1410	1575	525	475
	" " "	C.P.	"	0·551	7·8%	37	—	—	7125	9680	1349	2·17	15720	22"	1998	6·91	2985	6850	1396	1295	740	915	865	1680	980	600	945
*	" " "	BURMA GIRDLED	"	0·604	14·0%	43	—	—	9195	14965	1913	2·50	21890	27"	2478	10·74	5345	8525	1879	1445	1290	1190	1225	1355	1290	595	870
	TERMINALIA TOMENTOSA (SAIN)	U.P.	"	0·752	13·2%	53	—	—	9245	15380	1906	2·55	25755	48"	3474	10·60	4865	8275	2240	1720	2050	2145	2205	1605	1700	865	900
	DIPTEROCARPUS ALATUS (KANYIN)	BURMA	"	0·604	17·2%	44	—	—	6050	12505	1896	1·09	18565	30"	2208	8·95	4065	6500	1717	880	985	965	1110	1260	1485	615	845
	" TURBINATUS (GURJUN)	"	"				—	—	8095	15605	2240	1·66					3730	7745	2379	1185	1395	1285	1315	1160	1345	1260	880
	" TUBERCULATUS (IN)	"	"						7205	13925	1964	1·49					3540	6785	2167	900	1615	1565	1575	1380	1600	805	1075
	CEDRUS DEODARA (DEODAR)	PUNJAB	"				—	—	6555	10540	1453	2·44					4345	6130	1518	880	670	750	985	1065	1225	355	320
	ANOGEISSUS LATIFOLIA (BAKLI)	U.P.																									
	ARTOCARPUS HIRSUTA (HEBALSU)	MADRAS																									
	SHOREA ROBUSTA (SAL)	C.P.																									
	" " "	BENGAL																									
	" " "	U.P.																									

KILN DRIED TIMBER

	TECTONA GRANDIS (TEAK)	BURMA	KILN DRY																								
	" " "	MALABAR	"	0·649	9·5%	44	—	—	8380	14735	1827	2·25	18830	31"	2402	8·27	4730	7670	1981	1695	1100	1360	1100	1415	1620	1175	1335
	" " "	C.P.	"	0·549	8·0%	37	—	—	7660	11915	1421	2·29	17430	27"	2669	6·30	3365	6205	1373	1475	910	915	905	1270	1555	815	1025
*	" " "	BURMA GIRDLED	"						12705	16860	2060	4·40					7450	11135	1946	1630	1140	1265	1130	1085	1225	530	775
	TERMINALIA TOMENTOSA (SAIN)	U.P.	"	0·772	8·6%	52	—	—	12105	18370	2186	3·76	23770	50"	3175	10·06	5120	9635	2440	1875	2115	2085	2560	1630	1705	1110	1240
	DIPTEROCARPUS ALATUS (KANYIN)	BURMA	"						11105	13670	1914	3·59					6005	9420	2137	1115	1185	1105	1500	1265	1285	910	1015
	" TURBINATUS (GURJUN)	"	"						13470	19675	2523	4·10					9505	12430	2311	1360	1465	1425	1550	1325	1260	890	1030
	TUBERCULATUS (IN)	"	"																								
	CEDRUS DEODARA (DEODAR)	PUNJAB	"						10195	13160	1694	3·38					6525	8945	2049	1305	860	895	1190	900	775	255	350
	ANOGEISSUS LATIFOLIA (BAKLI)	U.P.	"																								

* MATERIALS WERE TAKEN FROM GIRDLED TREE AND SEASONED IN THE LABORATORY.

removed from the sleeper. This measurement is made correct to 0·00005 inch, as it has been found that there is a definite "*Elastic withdrawal limit*," or point up to which the withdrawal is proportional to the stress, and this degree of accuracy is necessary to detect the point. The importance of accurately locating the "Elastic withdrawal limit" lies in the fact that, stressed to any degree below that limit, when the stress is removed the spike recovers any slight withdrawal that the stress has caused, but stressed beyond that point the spike remains slightly farther out of the wood than it was at the beginning of the test.

As the result of many years of study of the application of strength tests to the problem of selecting sleeper-woods a "*Composite sleeper figure*" has been developed. This figure does not express any one property of the wood in physical units, but is a numerical representation of the "weighted and adjusted" average of all the strength properties of the wood that bear upon its usefulness as a railway sleeper. In the same table in which the "composite sleeper figures" are presented will be found the specific gravity, the side hardness, the compressive strength across the grain, and the spike-holding power both at the "elastic withdrawal limit" and at the greatest load necessary to remove the spike. It is thought well to present these values in juxtaposition to facilitate a comparison of the most important strength functions when considering the suitability of any wood for use as a railway sleeper. The great advantage of using the "composite sleeper figures" is that they are exactly comparable with the same figures prepared by the Forest Products Laboratory at Madison, U. S. A., for American sleeper woods.

Considering now the tables of results presented herewith *Table No. 1* (Plate 14) is a statement of the actual test results for all the Indian timbers that have so far been completely tested by standard methods under our Project No. 1. If it is desired to use this table to compare the strengths of any two species that part of the table entitled "Green Timber" must be used, because, if a timber contain less than about 30 per cent. moisture, its strength will vary very appreciably with changes of moisture content. When

timbers contain less than about 30 per cent. moisture their strengths can be compared if the moisture contents are nearly the same in the two woods under reference.

In *Table No. 2.* will be found the "composite sleeper figures" referred to above, with the other important functions written in the same line. In order to make all the strength figures in this table suitable for making comparisons between species, they have been corrected to their equivalent for wood having the same moisture content, *viz.*, 12 per cent.

TABLE No. 2. UNTREATED WOOD.

Species.	Sp. Gr. oven Dry.	Composite Figure.	SPIKEHOLDING POWER.				Comp. perpendicular to grain.*	Side Hardness.*	REMARKS.
			Optimum size of pre-bore.	Load at E. L.	Load at Y. P.	Max. Load.			
White Oak (U.S.A.)	0·59	1,040	...	....	...	...	1,300	1,365	
Teak (Malabar) ...	0·614	1,195	...	...	...	...	1,660	1,175	From Project I
Teak (Burma) ...	0·586	1,180	...	...	....	...	1,465	995	,,
(Sain) *Terminalia tomentosa.*	0·707	1,455	3/8"†	3,250	...	8,965	1,855	2,125	,,
(Kanyin) *Dipterocarpus alatus.*	0·574	1,040	...	...	...	....	1,280	1,030	,,

NOTE.—This table is prepared from the tests on untreated wood because the maps of data available is for wood in that condition, and because composite figures for foreign woods are based on the same condition, and consequently this table is the most useful for making comparisons. The tests on treated wood show that the treatment has not the least weakening effect.

Table No. 1 is included for reference only, and requires no explanation for the purposes of this report, except to say that it is from the figures contained in this table that Table No. 2 is compiled.

*The values correspond to strength at 12 per cent. moisture.

†Though the tests so far completed give an optimum value for $\frac{3}{8}$ in. holes, they are small in number and a close observation of the behaviour of the sleepers under test and of the wood after test leads to the conclusion that the best size of hole to use is the $\frac{1}{2}$ in. hole.

From Table No. 2 it will be evident that *sain* is superior in every respect to White Oak, one of the very best sleeper woods used in America, and decidedly so in its "composite sleeper figure." Thus, if its durability can be made satisfactory, a question discussed in another part of this report, it can be expected to make a sleeper in every way superior to White Oak, that is to say, superior to any imported sleeper that can be obtained at any price.

Unfortunately there are no figures available for the spike-holding power of White Oak, for though it has been tested in this respect in the United States the dog spikes, known as "Pensylvania Cut Spike," used in that country are of different design and size from the dog-spikes used on the Indian Railways. The following figures however are sufficient to prove that the spike-holding power of *sain* is more than sufficient to meet all railway requirements.

Table No. 3.

SPIKE-HOLDING TEST RESULTS

Species.	Condition.	Spike-holding power.		
		Size of hole	Load at E. L.	Max. load.
Douglas Fir ...	Untreated ...	½" ...	2,000 lbs. ...	3,070 lbs.
Deodar ...	,, ...		3,130 ,, ...	4,085 ,,
Pyingado ...	,, ...	[illegible] ...	5,125 ,, ...	5,855 ,,
,, ...	,, ...	[illegible] ...	6,950 ,, ...	7,830 ,,
,, ...	,, ...	[illegible] ...	5,065 ,, ...	6,750 ,,
Sain ...	Untreated ...	[illegible] ...	3,250 ,, ...	8,965 ,,
,, ...	,, ...	[illegible] ...	3,165 ,, ...	6,845 ,,
,, ...	,, ...	[illegible]	3,000 ,, ...	5,250 ,,
,, ...	Creosoted ...	[illegible] ...	2,835 ,, ...	5,905 ,,
,, ...	,, ...	[illegible] ...	3,165 ,, ...	5,495 ,,
,, ...	,, ...	[illegible]" ...	3,250 ,, ...	4,510 ,,

NOTE :—For *sain* the number of tests completed is still small and these figures may be subject at a later date to slight change. In some cases with the ⅝" hole individual spikes went above 4,000 lbs. at the Elastic Limit and to 9,700 at Maxium Load. In several cases the result could not be recorded as the spike itself broke, the holding power of the wood being greater than the strength of the spike

Conclusions.

From the results of the tests it is obvious that the mechanical properties of *sain* are more than sufficient to meet the requirements of the very best wooden railway sleepers, being superior to those of White Oak, one of America's admittedly best sleeper-woods.

From the *appearance* of the spike-holding tests, in addition to the results quoted above, the writer is convinced that the best results will be obtained by driving the spikes into pre-bored holes of $\frac{1}{2}''$ diameter, whether using treated or untreated wood, but the difference in holding power for pre-bored holes of different diameter is unusually small in this species, and there is no objection to using either $\frac{3}{8}''$ or $\frac{5}{8}''$ holes, except that former rather increase the danger of splitting and had better be avoided for that reason. Re-driven spikes hold extremely well in *sain*, the first re-driving giving results almost equal to spikes driven for the first time.

The treatment used in this series of tests, as described in another part of the report, gave exceedingly good penetration. The writer has never had to test wood that showed so complete a penetration, but there is no indication that it has had the slightest weakening effect on the wood. The slight variation between the results of tests on treated and untreated material lies well within the natural variation to be found in good timber of one species.

It was observed that it was somewhat easier to drive the spikes into the treated than into the untreated wood, and for this reason it was at first feared that the treated wood might not hold the spikes so well. The tests however proved conclusively that this was not the case, and that the spike-holding power of creosoted *sain* sleepers is extremely good.

Part II.

REPORT ON THE PRESSURE TREATMENT OF SAIN BROAD GAUGE SLEEPERS AT THE WOOD PRESERVATION PLANT, FOREST RESEARCH INSTITUTE, DEHRA DUN.

Sain (Terminalia tomentosa) is a very strong wood found in almost all parts of India and Burma. In Burma, Bombay and

Madras the timber is available in large sizes and quantities. The Chief Conservator, Bombay, estimates that about 7,500 B.G. and 75,000 M.G. sleepers will be available from the Bombay forests annually, for some years to come. Madras and Coorg can also supply large quantities, while *sain* is found in quantity throughout the deciduous and moist deciduous forests of Burma. The average life of such a strong and widely-distributed wood untreated, in the permanent way is only from 5 to 7 years, on the average, while with a proper pressure treatment of mixed creosote and earth oil (7 to 8 lbs. per cu. ft.) it is not too optimistic to reckon the life of the treated sleeper at about 15 years or the same average life as that of a Nepal *sal* sleeper. The price of *sal* to-day is in the neighbourhood of Rs. 9-8-0 per B.G. sleeper, while that of *sain* may be taken at Rs. 6 to Rs. 6-8-0. Thus, with an additional total cost of Rs. 2 to Rs 2-4-0 per B.G. sleeper, according to the capacity of the wood preservation plant and the relative proportions of creosote and earth oil used as antiseptic for treatment, it is anticipated that the life of the sleeper is enhanced by about 10 years It is easy to see how sound an economic proposition a treated *sain* sleeper is when compared to *sal* or *pyinkado*, both standard sleeper woods of India. Assuming an amortisation rate of 6 %, calculated on the actuarial basis, the economic cost per mile per year of treated *sain* is equal to Rs. 2,409, whereas, the corresponding figures for the two standard woods above referred to are Rs. 2,537 and 2,533 respectively.

Previous Experiments.

This wood was treated by the Forest Economist 10 years ago, by boiling the sleepers in creosote for 24 hours in open tanks. The average absorption obtained was about 3 lbs. per cu. ft. Of 524 B. G. sleepers thus treated and laid in the G. I. P. Railway, Itarsi Nagpur Section, 507 are still in excellent condition, 9 are showing signs of cracking and 8 have been rejected. The sleepers are therefore doing extremely well and may be expected to last several years longer. The strength of this timber has been dealt with in Part I of this report and as it is

an extremely strong timber it is thought that with an absorption of 7 to 8 lbs. per cu. ft. the rejection of a pressure treated sleeper, due to want of durability will synchronise with the failure of the sleeper from mechanical abrasion, rail-cutting or spike-killing.

PRESENT EXPERIMENTS.

General.—Experiments were conducted recently in the Experimental Wood Preservation Plant of the Forest Research Institute, Dehra Dun, by treating *sain*, B. G. sleepers by the Full Cell pressure process, aiming at an average net absorption of 7 to 8 lbs. per cu. ft., with the sleepers dry after treatment. In all, 220 B. G. sleepers were treated, of which, 40 were from Bareilly being *sain* from the U. P. forests, and the remainder extracted from the Bombay forests and treated on behalf of the B. B. and C. I. Railway, 5 were also handed to Timber Testing Section for strength tests. All the sleepers were pre-bored with $\frac{5}{8}''$ $\frac{3}{8}''$ or $\frac{1}{2}''$ holes according to the O. and R. R. or the B. B. and C. I. specification (the Bareilly ones being according to the O. and R. R.). Half an inch deep chisel identification marks were made on them to facilitate proper inspection of the sleepers for actual durability tests in the line. The general form of the chiselled marks is shown below :—

A, B, C, D or E.
T.T.
8—?

The letter A, B, C, D, or E indicates in each case the composition of the antiseptic use.

A indicates a mixture of equal proportion of coal tar, creosote and earth oil.

B ,, 1 part of creosote with three parts of earth oil.

C ,, pure raw wood tar obtained from the Mysore Bhadravati Iron Works.

D ,, a mixture of equal parts of the wood tar with earth oil.

E indicates a mixture 1 part of creosote with 2 parts of earth oil.

T. T. indicates the botanical name of the wood (*Terminalia tomentosa*).

8 is the number in the list of woods given in our specification for Project No. IV.

? is the serial number of the sleeper treated according to Project No. 4.

Table 4 gives the analyses of the (1) wood tar, (2) earth oil and (3) creosote and earth oil mixed, used in these experiments. It will be observed that the creosote conforms closely to the British standard specification, the wood tar contains a fairly high proportion of acetic acid and the earth oil appears to be fairly heavy.

Table No. 4.

ANALYSES OF ANTISEPTICS.

(1) Wood Tar.

Density = 1·108. Moisture = 5·8 %.

Acids soluble in Caustic Soda = 24·4 %.

Corrosive acids calculated as Acetic Acid (included in above figure) = 2·9 %.

Matter soluble in water calculated on original Tar = 17·9 %.

Distillation—

Up to 150°C	10·0%	235° — 245°C	5·2%
150° —170°C	1·0 „	245° — 255°C	8·4 „
170° —205°C	7·2 „	255° — 270°C	6·1 „
205° —225°C	7·3 „	270° — 280°C	2·1 „
225° —235°C	7·6 „		

Residue above 280°C was solid pitch = 45·1 %.

(2) Earth Oil.

Density @ 28°C = 0·876.

Distillation—

Up to 170°C	0·21 %	245° – 255°C	3·9 %
170° – 205°C	1·0 „	255° – 270°C	7·4 „
205° – 225°C	1·0 „	270° – 290°C	12·4 „
225° – 235°C	1·3 „	290° – 305°C	11·7 „
235° – 245°C	2·2 „	305° – 315°C	10·1 „

Residue above 315°C = 48·8 %

(3) *Creosote and Earth Oil Mixture.*

Density = 1·027. Moisture = 1·6 %.

Acids soluble in Caustic Soda = 5·5 %.

Distillation—

Up to 170°C	0·2 %	255° – 270°C	8·0 %
170° – 205°C	1·8 „	270° – 290°C	8·0 „
205° – 225°C	5·0 „	290° – 305°C	6·8 „
225° – 235°C	4·1 „	305° – 315°C	4·1 „
235° – 245°C	5·5 „	315° – 330°C	6·1 „
245° – 255°C	5·0 „		

Residue above 330°C = 45·4 %.

The U. P. lot Nos. $\frac{T.T.}{8-1}$, 3, 5, 6, 7, 8, 9, 10, 11, 13, 16, 20, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 34, 37, 40 and 45 of the Bombay sleepers Nos. $\frac{T.T.}{8-41}$ to 85 inclusive were treated with a mixture of equal parts of creosote and earth oil (A).

Another 45 of the Bombay lot Nos. $\frac{T.T.}{8-68}$ – 130 inclusive were treated with a mixture of 1 part of creosote with three parts of earth oil (B).

Nos. $\frac{T.T.}{8-13}$, to 160 were treated with Wood Tar (C).

Nos. $\frac{T.T.}{8-181}$ to 205 with Wood Tar and Earth Oil in equal proportions (D) and Nos. $\frac{T.T.}{8-206}$ to 220 with Creosote and Earth Oil in proportion 1 : 2 (E).

In each case, the average amount of antiseptic injected under pressure was 7 to 8 lbs. per cu. ft. and it remains to be seen if the extra cost due to the higher proportion of creosote is justifiable on economic grounds. Except the U. P. lot which are placed in the O. and R. Railway the others will be

removed to the B. B. & C. I. permanent way and annual inspections will be made. Till the experiments are closed, it will be impossible to predict accurately on the basis of the relative toxic values of the mixtures alone, which of the mixtures is the better economic proposition. It should be remembered that creosote costs about 80% more than earth oil. Considering the large numbers of sleepers that will be treated in the near future in commercial treating plants, it is essential that careful inspections should be made of these experimental sleepers, and cautious inferences be drawn from the records to decide between them. It should here be mentioned that experiments have shewn that earth oil by itself has very little preservative value and in these experiments is regarded solely as a diluent for the antiseptic oil.

Material.

The U. P. material of 45 sleepers were treated in three charges and the Bombay lot was treated in 12 charges of 15 sleepers each. Except for about 10% of the sleepers treated, all had a moisture content of less than 25% at the oven-dry weight at the time of treatment.

Treatment.

General.—All the *sain* sleepers with the exception of Experiment E in which the Lowry Process was used were treated by the Full Cell Process, the average temperature of the antiseptic was in general, 160° F. The average net absorption of the antiseptic was 21—24 lbs. per sleeper. The maximum pressure used during the impregnation was about 175 lbs. per sq. in. In no case was a higher preliminary vacuum given than 15″ for more than 20 minutes, or a final vacuum of more than 0—13″ beyond 15 minutes.

Though it is advisable to allow the pressure to rise steadily, in order to get comparative results with regard to the rate of penetration of different antiseptics at different pressures it was found necessary to maintain the pressure at predetermined values for identical periods of time by opening a by-pass on the pressure

pump and allowing the oil to flow back to the service tank instead of entering the cylinder and so building up the pressure beyond the value required. In general the treatment was as follows :—

The pressure cylinder was charged with 15 B. G. sleepers at a time and the door securely fastened. An initial vacuum varying from 0—10" to 0—15" was drawn, chiefly for expediting suction of oil into the cylinder and also, in addition, to suck out some air from the surface layers of the wood, thus facilitating penetration of the antiseptic into it, especially during the earlier stages of the pressure period. On opening a valve the antiseptic was allowed to rush into the pressure cylinder till it was nearly full, when the valve was closed and the vacuum destroyed. The cylinder was filled completely by pumping in more oil. When this was done the cylinder was completely closed and oil was forced in by a mechanical pump from a calibrated service tank. The oil pump was allowed to pump the antiseptic through a non-return valve into the cylinder. At first, the rise in pressure was slow, but subsequently, the pressure rose rapidly. It may be mentioned that as long as the rate of absorption by the wood is equal to the rate of the ingress of the oil, the pressure does not rise. But when this equilibrium is disturbed, and the pump forces in more oil than the wood can absorb in a certain time, the extra oil builds up a pressure. In all the experiments made with *sain*, the by-pass was first closed and the full delivery of the pump diverted into the cylinder. With the A and B mixtures the pressure rose in 5 mins to 100 lbs. per sq. in. at which it was maintained for 5 mins. by adjusting the throttle valve in the by-pass. Subsequently, the pressure was raised to 125 lbs. per sq. in. which was maintained for 5 minutes and then raised to 150 lbs. per sq. in. at which value it was maintained steadily for 15 mins. The pressure was then allowed to rise (closing the by-pass fully) to 175 lbs. per sq. in. which was held till a gross absorption of 27—30 lbs. per sleeper was obtained. When the absorption was complete all the oil was expelled from the cylinder ; the expulsion of the oil being expedited by forcing air into the cylinder. The level of oil in the service tank before and after the various stages of the pressure period was observed.

Finally, a light vacuum of 0—12″ for about 12 mins. was drawn and the process finished by transferring any oil so drawn from the wood to the calibrated service tank. All the sleepers were individually weighed before and after the treatment, and their moisture contents noted.

Autographic recorders for temperature and pressure recorded the temperature and pressure conditions of the sleepers and the antiseptic during the various stages of the charge. In the Lowry Process the preliminary vacuum was not drawn, and the final vacuum was of half an hour's duration.

Bombay sleepers from the B. B. & C. I. Ry.

200 sleepers sent for treatment from the B. B. and C. I. Railway were fairly well-seasoned at the time of treatment. They were utilised for a dozen charges to investigate the relative penetration of the various antiseptics above referred to (the remainder being rejected for original defects). In seven of the charges, the sleepers were impregnated with mixtures of coal tar creosote and crude oil, two with raw wood tar and three with a mixture of equal proportions of wood tar and earth oil and the remaining one with a mixture containing one part of coal tar creosote to two parts of earth oil.

Experiment 1.—The first lot of 45 sleepers were treated in three charges using a mixture containing equal proportions of creosote and earth oil. The pressure period was in general about 1½ hrs. Though the sleepers were well seasoned (average moisture content being 22%), a preliminary vacuum of 0—15″ was found to expedite absorption. There is no evidence to indicate that a preliminary vacuum would make the absorptions more erratic, when a fairly high absorption of 21—24 lbs. is secured. The average charging temperature for the three charges was 160° F and this appears to be quite suitable for the treatment of this wood, the moisture content being below 25%. The average specific gravity of the wood, based on air-dry weight of the sleepers was nearly 90.

Experiment 2.—The next lot of 45 B. G. sleepers with an average moisture content of 23% were treated in three charges

with a mixture containing 1 part of creosote and 3 parts of earth oil. A small quantity of pitch was precipitated, but it was neither excessive nor was it present in suspension to interfere with the penetration of the preservative into the wood, by blocking the pores. The average absorption for the three charges was slightly over 23 lbs per B. G. sleeper working on exactly similar lines to experiment 1, so that practically there is no difference as regards relative penetration between the two mixtures used. An average charging temperature of 160° F. was used. The penetration in both the above experiments was complete, oil appearing all through the wood. This may be considered as a most satisfactory result, as better penetration could not be desired.

Experiment 3.—Another lot of 30 B. G. sleepers with an average moisture content of 21% was treated with wood tar in two separate charges. The same charging temperature of 160° F. was adhered to.

The absorptions appeared, under exactly identical conditions, to be about 20 % more rapid than in the case of the two mixtures of coal tar creosote with earth oil. But the depth of penetration was disappointing, being only about 20% of that secured in experiments 1 and 2, though in the two charges of this experiment a total net absorption of 7 to 8 lbs. per cu. ft. was secured.

This is probably because wood tar as it penetrates into the cooler strata of the wood becomes less mobile, retarding further penetration into the wood. Inspecting the sections after cutting some of the treated sleepers, it was, as might be expected, found that though the longitudinal absorption was slightly better than the radial, the penetration had not exceeded 1″ on the sides and 4—6″ at the ends. The black solid tar and pitch could be seen blocking the pores of the wood. The importance, for this species, of the complete penetration of the antiseptic into all parts of the sleeper is very great, as, due to the greatly varying conditions of temperature and humidity coupled with the somewhat high shrinkage values of this wood, it has a tendency to crack in the railway line, exposing interior regions

of the sleeper to attacks from white ants, fungus, etc. All the sleepers treated in Experiments 1 and 2 satisfied this important condition.

An important objection to using raw wood tar for pressure treatment lies in its containing a relatively large percentage of bodies of the acetic acid type, which give rise to trouble with the plant. However, this is an objection that can be got over by suitable treatment.

Ignoring for the moment the relative toxic values of wood tar and mixtures of coal tar with earth oil, an objection to the use of wood tar alone is that despite high absorption values the penetration is low for the reasons cited previously.

Experiment 4.—The fourth lot of 45 sleepers with an average moisture content of 20 per cent. were treated in three separate charges with a mixture containing equal proportions of wood tar and earth oil.

Working on a similar specification for treatment to that used in the three previous experiments, the first day, the absorption appeared to be about 15 per cent. less rapid than in the case of wood tar. It may for all practical purposes be assumed that the rate of absorption obtained in this case was on a par with that obtained in the first two experiments. To secure an absorption of 7—8 lbs. per cubic feet 1½ hour of pressure treatment in accordance with the specification described before was found to be necessary and sufficient to give good penetration.

On the second day, to get the same absorption under exactly identical conditions with the first charge, a little over two hours of pressure period was found to be necessary, the average temperature of the charge was however only about 130° F. How far the slower penetration of the mixture was influenced by the lower charging temperature is not known at present, but it is thought it was most probably due to the presence of a large proportion of pitch in the mixture.

A day later, the third charge of Experiment 4 was conducted adhering to the previous specification. The pressure treatment was continued for 2½ hours and the absorption could not be

improved over 20 lbs. per sleeper. On examining the mixing tank a large amount of pitch was found at the bottom. With the agitation created by the suction of the pump, the precipitated pitch thickens the consistency of the charging oil, and this tends to block the pores of the wood.

It is noteworthy that an oil such as earth oil containing paraffins throws down a thick viscous bituminous substance when mixed with wood tar. The same phenomenon is observed with Crude Coal Tar but not with Creosote.

Experiment 5.—The last charge consisting of 15 B. G. sleepers with an average moisture content of 17 per cent. was treated with a mixture containing one part of creosote and two parts of earth oil. The same results were obtained as in Experiments 1 and 2.

Conclusions and Economic Considerations.—From the above experiments, *sain* appears to be easily amenable to pressure treatment. Coal tar creosote mixed with crude oil besides being an excellent business proposition, can be injected into the wood under pressure in about 1½ hours securing a net absorption of 7—8 lbs. per cubic feet, the penetration of the antiseptic extending to all parts of a B. G. sleeper A preliminary vacuum of 0—15" for about 15 to 20 mins. is beneficial, as the wood in question has long clear pores without tyloses. A final vacuum of 0—13" for about 13—15 mins. ensures not only the dryness of the sleepers after treatment, but prevents their "sweating" in summer.

It is a moot point however whether the saving in time for duration of pressure will compensate for the loss of time in drawing a preliminary vacuum. It should be remembered that no sleeper with a moisture content of over 25 per cent. should be treated except in very special circumstances and even then it should not exceed 30 per cent. Considering the high mechanical strength values of this wood, and the great difficulty of obtaining absorptions over 8 lbs. per cubic feet it is economical to secure a net absorption of 7—8 lbs. per cubic feet with uniform treatment. Following the specification indicated above, in a modern commercial wood preserving plant, equipped with efficient and independent air and oil pumps, three charges of the wood can be treated in a day.

PART III.

THE DURABILITY OF TREATED SAIN SLEEPERS.

The available information on the durability of treated *sain* sleepers has been dealt with in various reports issued from time to time by the Economic Branch of the Forest Research Institute. The latest information on the subject is given in Forest Bulletin No. 53 of 1924, a summary of which is given below :—

Species.	Treatment.	Time in the line.	Results according to classes.			
		Yrs mts.	A per cent	B per cent.	C per cent.	R per cent.
Sain, Terminalia tomentosa B. G sleepers, laid in different sections of the O. and R. and N.-W. Railways.	Powellising.	10 9	42·8	46 9	4·7	5·6
Ditto.	Treated in Open Tanks with a mixture of Creosote and Earth Oil.	7 0	85·7	11·1	1·7	1·5

Note —A.—Good in all respects.
B.—Slightly split, decayed or white ant attack slight.
C.—Badly split, decayed or attacked by white ants.
R.—Rejected.

The experiments are not complete, though the results to date clearly show that a treated *sain* sleeper to be an extremely attractive proposition. As a matter of fact we have some of this year's reports on these sleepers, that is a year later than those given above but as all the reports are not as yet in the composite figures cannot be given. The inspections so far show that the sleepers are much in the same state as they were last year. Taking powellised *sain*, of which we have the longest records, this year's records show over 85 per cent. still in A and B class, in other words sound sleepers which are expected to last at least 4 or 5 years longer. It should here be mentioned that an untreated *sain* sleeper lasts from 5 to 7 years, while the above results are of either powellised or of sleepers treated in open tanks.

From the results given elsewhere in this note it will be seen that this hard timber treats well under pressure, complete penetration being possible, and this factor makes the proposition the more attractive.

PAX BRITANNICA.

In looking through some old files the other day I came across some interesting letters written in the early seventies about the original demarcation of the reserved forests in my division.

In 1873 Mr. R—, District Officer, was ordered to adjust the forest boundaries and to complete settlement records with the help of Mr. B—, the Forest Officer. His final report was dated 15th September 1873 and is on my file. Naturally it is very interesting to me but whether it will be equally so to other readers of the *Indian Forester* I do not know. However I will take the risk of quoting some extracts.

"In accordance with these instructions Mr. B—, the Forest Officer of J— met me at K— on 6th May. We started next day and went steadily through the pergannah. examined every piece of forest land that had been left out, and completed the work on the 20th June."

This in itself was marvellous when one considers the nature of the country. They were giants in those days! Nevertheless Mr. R— is quite apologetic, for he goes on :—

"It may perhaps be thought that we took a very long time, but it must be borne in mind that in the greater part of the country we had to go through, there were no roads. We had to walk every inch of the way, and had daily to ascend and descend between two thousand and eleven thousand feet. People who have been accustomed to settlement work in the plains or in hills that are either intersected by roads, or are of themselves round and of an easy gradient, can form no idea of the labour we had to go through. Had it not been for the intimate knowledge of locality possessed by Mr. B— we should have been *even longer* than we were."

The italics are mine.

"We felt the want of a map very much.....we, however did everything in our power to make our work practically correct."

Dear old R—! It is difficult to imagine the present generation of District Officers taking all this trouble, even if they had the time to devote to it, which they have not.

"The Syanahs* of the khutts were always with us when we were inspecting their khutts, and some of the most influential Syanahs accompanied us throughout."

I should indeed think so! They must have regarded with fear and trembling this unwanted incursion into their territory.

"They were all encouraged to speak out freely, and in cases of doubt we discussed the matter at length."

Picture it! The wretched Syanahs gesticulating wildly and the phlegmatic Englishman calmly smoking his pipe!

"The Syanahs urged everything they could against land being taken up and Mr. B— urged the points in favour of it, and I then decided."

Mr. B— seems lucky to have escaped with his life!

"I have always endeavoured to err on the side of liberality and have invariably in cases where I had any real doubt about expediency of giving up or retaining lands, decided in favour of the villagers.

"In only one or two instances have the Syanahs of the khutts from which land was taken assented to the justice of it, but in very many have the Syanahs who accompanied me agreed that it was quite just and fair."

This was too much for me. I slid off my chair and subsided into a heap on the floor. After five minutes paralysis I climbed on to my seat and read on.

"During my whole tour I kept in view the idea of European settlers, either tea-planters or others, I however saw no open

* A Syanah is the headman of the group of villages. The latter is known as Khat, modern spelling.

unoccupied lands which would be worth the while of any man of capital to take up."

Oh Capital! what sins have been committed in thy name! This should be read before the Fabian Society as an illustration of the economic principles actuating a capitalist regime pledged to lift up subject population from ignorance and idolatry!

"Every spring, every streamlet and every pond has already been taken advantage of by the native cultivators."

Selfish wretches!

"I saw some places within forest bounds where the land was splendid, where the climate must be perfect, and where the work of breaking up and cultivating would be quite easy, but there was no water. If tea or mulberry trees could be carried through the first three years, then I have little doubt but that they would grow luxuriantly, but I much fear these first three years could not be got over."

Mr. R— now becomes an enthusiastic nature worshipper almost an artist or a poet.

"At the same time, the position of some of these places is so beautiful, surrounded by the most magnificent scenery, with splendid specimens of forest trees on all sides and surrounded by wild flowers and ferns of every description, that I can well imagine a true lover of nature being contented to take up his abode there for ever, could he but scrape together the bare necessaries of life."

That must have been after a particularly strenuous climb!

"Having been so long in undisturbed possession, the villagers began erroneously to look upon the forest lands as their own and now try to persuade themselves that Government has acted harshly towards them."

Evidently seeing the futility of trying to persuade Mr. R— as well! In his eagerness Mr. R— exposes himself to the risk of a libel action for he continues.—

"To persons who are unacquainted with the facts of the case they do not attempt to set up any such claim or grievance but

they have a number of stock arguments which they pour into the ear of any new comer, and which, if he be like our late visitor, Captain M—, utterly ignorant of the circumstances and ready to believe in any grievance against the Local Government without taking the trouble to make enquiry from the local officers, would sound very plausible, and might in the absence of local officers, well acquainted with the previous history of the case, give a good deal of unnecessary trouble."

The only local officer available for consultation was the inimitable Mr. B— whom he had at his elbow all the time! Oh, Mr. B— I fear you are condemned to simmer in the bottomless cauldron unless old age has humanised you!

"Once or twice everything seemed amicably arranged, and the Syanahs made up their minds to sign, but again something put them off. I observed that whenever we were near C— they seemed more cantankerous and litigious. There was evidently some influence at work there."

Captain M— perhaps.

"They at first were in the habit of holding out a threat of running away. They said the assessment was too high and their jungle was taken away, and so they would not stay, but would run off to Garhwal or Nahun, etc. I told them they were at perfect liberty to run away, but if they did they would never be allowed to come back again. They would then become very penitent and want to sign at once; in fact behaved just like foolish children.....

"It takes a great deal to make a hill man move. A man in the plains when he makes a little money as a rule lays it out in jewellery for his wives and children, which he can carry about with him. A hill man lays it out in a house. From the severity of the weather, hill men have of necessity to build good houses, but they go beyond this and lay out a lot of money on two or three storied houses when one storey would suffice."

Rot! They live in the top storey, keep their sheep and goats in the first and their cattle on the ground floor.

"They also have their door posts and lintels elaborately carved and cut, where plain work would do just as well."

Oh Mr. R—, where is your artistic sense? Can it only be evoked by fatigue or was that a mere flash in the pan?

The above quotations and my somewhat facetious comments on them are an excellent example of the well-known method, so beloved of politicians and journalists, of misrepresenting a man's character and motives by divorcing from the context the vulnerable parts of a speech or report.

By the above method it would be just as easy to make out a good case in defense of Mr. R— as against him. As a matter of fact he must have been an officer of more than usual kindness and sympathy, as is shown by the following extract from the end of his report.

"There is only one more matter which I would again urgently bring forward—that is, the appointment of the Divisional Forest Officer in J—. As I pointed out in former years, in the whole of B— and K—, and in the upper khutts of J—, the Government forests and the village lands are so intermixed that the Divisional Forest Officer must always be the leading power, and in his hands the weal or woe of the people in a great measure rests. If he is a hot tempered man, without patience to their childish, often frivolous complaints, and if he considers that the sole duty of Government is to grow deodar trees and maintain fire-lines, then people must suffer. If, on the other hand, he is a patient, good-tempered man, who has sympathy with the people and understands the Government has a duty to perform by them, the people will be happy. There is no reason whatever why the interests of Government should suffer because the interests of the people are kept in view."

Hats off to Mr. R—! There ought to be more like him.

D. F. O.

PRIZE-DAY AT THE FOREST RESEARCH INSTITUTE AND COLLEGE, DEHRA DUN.

The annual prize distribution of the Provincial Service and Ranger classes was held in the grounds of the Forest College on the 29th March 1924. The certificates and prizes were presented by Mr. P. H. Clutterbuck, C.I.E., C.B.E., V.D., Inspector-General of Forests. Mr. W. Perrée, C.I.E., President of the Forest Research Institute and College, opened the proceedings with his report on the work of the students during the year.

"MR. CLUTTERBUCK AND GENTLEMEN,—

With your permission I propose to give you a short account of the educational work of the past year and of the results attained by the classes, which have now completed their training.

The Provincial Class started on the 1st April 1922 with 22 students. One student rejoined after absence from illness for the second year, and one student unfortunately was drowned in June last.

With the exception of one student, who contracted enteric fever and lost part of his lectures during the last rains term, all the students have followed the full course.

Of the 22 who have completed the training, two have failed to obtain Provincial Forest Service certificates, but I feel justified in awarding each of them, under Rule 18, the Ranger's higher certificate. The rest of the class, 20 in number, have obtained pass certificates. It is a great disappointment to us all that no one has obtained honours. The topmost men did very creditably but the standard of honours demands a minimum of 70 per cent. in each of the major subjects and 80 per cent. of the grand total. A general all-round excellence is therefore essential, which none of this class has quite attained Again I have had to help a few with grace-marks in some of the major subjects. The main Forestry subjects, comprising Silviculture, Working Plans and Utilisation were on the whole satisfactorily understood. Our text-books are not invariably up-to-date, and much progress has

been made in all branches since the text-books were written. It is therefore necessary for students to read extensively all forestry publications in order to obtain up-to-date knowledge. The Central Library contains the works of reference required. The course in Utilisation has gradually extended with the expansion of the Economic Branch, and now includes demonstrations in the workshops and laboratories. The answers to some of the questions in the paper on Utilisation, reflect special credit on Mr. Nagle's competence as a demonstrator.

This class received its practical instruction in the forests of Chakrata, and of the Dun and finished with a very instructive tour in the Bengal Duars. The working plan was drawn up at Kansrau.

It was again found impracticable to send the class to the teak forests of Malabar, as the damages resulting from the Moplah rebellion had not been sufficiently repaired.

Taking the students who have been granted pass certificates the class compares not unfavourably with previous years. There are unfortunately two failures. These are attributed to the poor standard of education of the students prior to admission. The results in the case of these two students at the end of the first year were poor, but not so bad as to render the possibility of passing hopeless, and we all hoped for the best. One of the students who failed deserves some consideration in view of his war service, but I cannot go further than the award of a higher standard Ranger's certificate.

The Ranger class opened with 46 students ; two were removed during the first term for incapacity; two were dismissed last year as explained in my last report, and one resigned, leaving 41 to complete the course. With the exception of one student, who suffered from serious illness during last rains, all students completed the full course.

The result of the examinations are on the whole satisfactory, and closely analogous to those of previous years. Six students have attained honours, 30 have obtained higher standard and 5 have been awarded lower standard certificates. Taking the

class as a whole, the average of the men in the first two dozen is generally satisfactory, but there is a rapid fall in the lower half of the class.

The practical work was done in the hill forests of Kumaun and the Dun, during the first year. Stock-mapping and enumerations were done in the Dun at Kansrau in the second year, and a most instructive tour was made in the Gorakhpur and Etawah divisions during the last term.

In Sulaiman Khan the Punjab has a student of whom we may all feel proud. Not only has he an excellent record as a scholar, as a practical man in the forest, and as an excellent example to those around him, but he has also an excellent record of service in the Army. He served in Europe as a duffadar, and it is a fit culmination to the services which he has already rendered to his country, that he should now reap the highest reward which this College can confer.

Dealing now with matters of general interest, which are common to both classes, I may mention that the examiner in Survey kindly lent us by the Thomason College, Roorkee, considers that in both the Provincial and Ranger classes there is an improvement in familiarity and practice with survey instruments. There is still, among the rangers, too much time taken in setting up and reading the level. The written papers are stated by Mr. Cumming to have been above the average.

The standard of conduct and discipline has been well maintained, and I am glad to report that there has been no expulsion during the past year. The games and physical drill which we consider an essential part of our course, were well attended. Through the kindness of Commandant of the Royal Indian Military College, the physical drill instructor was lent to us during rains term, and was able to make the course both instructive and interesting. The Marathon Race again attracted a good entry, and the times were on the whole good. The sports provided fair entries and the events were well contested.

The health of the students was generally satisfactory, but our bill of health was marred by the case of enteric already

alluded to, and a somewhat serious outbreak of dengue fever in the autumn. The health of the students while absent from Dehra on tour has been conspicuously good.

The Inspector-General's Cup to the best all-round athlete has been awarded this year to Harnam Singh, a student of the Senior Provincial Service Class. I think all will support this decision and there was not, as was the case last year, any doubt as to the selection of the winner of this valuable prize.

The Monitor system has continued to work satisfactorily and special thanks are due to those students who have given their help in the arrangements during tours, and in the running of our educational work generally. It may not be sufficiently appreciated that monitors have duties analogous to those of the adjutant and the quartermaster of a regiment, with the essential difference that they have no power to impose discipline. Tact and a desire to work for the common good are essential. The task is rather a thankless one, and there is not much competition for it. It is the more creditable therefore to our monitors, who invariably carry out their duties so efficiently and smoothly.

Again we have to record the loss of a most efficient and popular instructor. Mr. Bourke, who has been selected for post of special responsibility in Siam, is about to leave and while we all wish him the best of health and happiness in his new appointment we all feel deeply the sorrow of his departure. Mr. Bourke has by his personality, generosity and hard work done a great deal for the Ranger classes, specially in raising the standard of Utilisation and in bringing the Museums to a higher state of usefulness, and it is regrettable, now that he has got thoroughly into the swing of his work, that he should have to leave. We are also about to suffer an almost equally serious loss in the departure of Mr. De, who is anxious to proceed on furlough in order to visit European Forests. Mr. De had a distiguished career in the Provincial Service class. I think we can all say that he has added to his reputation by his work as an instructor at the College, and I am sure I express the feelings of all present when I say that we shall also deeply feel his loss.

We have in Mr. Wood a new addition, who fortunately has been appointed specially to our instructional staff. The policy of the Inspector-General, to obtain a number of officers permanently for service at Dehra Dun with the classes, is sound, and will remove many of the disabilities which we have suffered from in the past owing to frequent changes in our teaching staff.

All Forest Officers in whose territories the classes have carried out their practical training have continued to render the most unselfish assistance, and I may specially mention Messrs. Bhola, Makins, Wood, McDonald, Bailey, and Palmer in the United Provinces and Messrs. Shebbeare, Homfray, Glasson and Hodge in Bengal. To the whole Forest Research and College staff I have to express my gratitude for the interest and trouble taken to maintain the educational work at the standard, which is expected of our students at the present time. It has been my endeavour, during the five years in which I have been connected with this institution, gradually to improve the standard so as to meet with the increasing demands, which progress and new developments make on the staff, and I must leave others to judge whether my efforts have been attended with success.

I mentioned last year that some important changes in the rules of admission were then contemplated. The Government of India after consideration, arrived at the conclusion that the time was inopportune for the introduction of drastic changes owing to the relatively small demand which is now being made on our classes. The time was considered not ripe for changes which might affect the numbers. The general financial stringency has resulted in a considerable reduction in the demand for studentships, but I feel sure that this is only a temporary derangement, and that within a few years normal numbers will be again present in both the Provincial and Ranger classes.

We have, I think definitely, at last, to bid good-bye to the last batch of Bombay students to be trained at the Dehra Dun College. The final arrangement now is that the Bombay Government sends its Ranger students to Coimbatore. We much regret

that the association of many years must at last be broken, but I believe this to be in the interests of all concerned, and it is with a view to the more or less equal distribution of training between the two Ranger colleges in India, that this arrangement has been arrived at.

We had hopes that the Hon'ble Member, or at all events the Secretary, would be with us to-day, but neither has found it possible to be present. I shall now ask Mr. Clutterbuck kindly to present the certificates and prizes to the outgoing students."

The Inspector-General of Forests then gave the following address:—

"MR. PERREE AND GENTLEMEN,—

It is very disappointing that neither the Hon'ble Member Sir Narasimha Sarma, nor the Secretary, Mr. M. S. D. Butler, could be present to-day. They both asked me to express their regret at not being able to come. During the past two weeks two parties of Hon'ble Members from both Houses of the Central Legislature have visited Dehra Dun. All of the Members took a keen interest in what they saw, and it is to be hoped that similar parties will visit Dehra Dun every year, so that the work both in forest education and research, that is being done here, may become more widely known and appreciated.

The President of the Forest Research Institute and College has just given us a very complete account of the results of the educational work of the past year so that there is little for me to add. As regards the Provincial class it is disappointing that no one has obtained Honours; but on the other hand it is satisfactory that the average standard attained by the class was good.

The Senior Rangers have done well in that six of them have obtained Honours. I congratulate them all and specially Sulaiman Khan, about whom Mr. Perrée has given us such an excellent account.

The President's report as regards conduct and discipline is most satisfactory and altogether the general progress has been substantial. The only regret is that two of the Provincial Service

class, and five of the Ranger class have failed to pass. I appeal to all of the junior students to make up their minds to pass next year. With smaller classes it should be possible for each student to avail himself of the Instructors' help to a greater extent than ever, and thus render the training more intensive.

We are very sorry to say good-bye to the Bombay Ranger students. One can never foresee what will happen in the future, but it appears to be certain now that there will be no more students from Bombay, for the Ranger course here as it has been definitely decided for them to be trained in future at the Madras Forest College, Coimbatore.

It is indeed a loss to the College that Mr. Bourke is leaving. He has been here for little less than two years, and during that time he has worked so whole-heartedly for the good of the College, of the students and of the department in general that it will indeed be difficult to fill his place. We congratulate him however on having been appointed to such an important sphere of work, and wish him every success and happiness in his future career.

Mr. De, too, is about to leave us at his own request. He has been here for three years and has done splendid work. We are very sorry he is going, and wish him a happy time on leave.

Mr. Perrée has mentioned the great assistance which we have received from territorial forest officers of the areas in which the various classes have been trained. I heartily endorse his appreciation of their invaluable assistance. I likewise endorse his thanks to all the staff of the Forest Research Institute and College for their unselfish work to endeavour to improve the standard of education here.

The past two years have resulted in considerable progress in the scheme for the New Forest Research Institute. Two years ago, hardly a brick was laid, and now we have the Economic workshops already beginning to function, while the wing of the new main Research Institute building has been sanctioned, and its construction will start immediately. Considering the difficulties of the financial situation, which we have had to contend with since the war, we can congratulate ourselves on having attained this progress. We hope now gradually to be able to build up the

finest Forest Research Institute in the Empire. The results of the part, which has come into being already will have a marked effect on the future forest education in India.

Independently of the question of training Imperial Service Officers at Dehra Dun, which is still under consideration, the students who now come here both in the Provincial Service and Ranger classes, are able to obtain a greater insight into the possibilities of forest development than has ever been possible in the past. Whatever changes may gradually occur in the administration of the forests under the Reforms, it is hoped that by maintaining the training of Rangers, Provincial Forest Officers and ultimately Imperial Forest Officers at Dehra Dun, we shall build up and create a bond among forest officers in India that will unite them closely together, so that the development of the science of forestry, and the efficient conservation and management of forests will go steadily on. Our ideal is that every student who passes out from here should look towards Dehra Dun as the home of Indian forest education and research. It is hoped that everyone of you students will try to keep in touch with Dehra Dun and to visit the Institute occasionally, as opportunity may offer, in order to keep yourselves up-to-date. If we all do our utmost to foster a strong *esprit de corps* in the various branches of the service, with Dehra Dun as the focus attracting them all, it will augur well for the future of forest work, in spite of whatever disintegration may come in the provinces from further decentralisation.

It is difficult to say much that is new to you outgoing students. You have reached a definite point in your life and are now about to start your careers. I know you have absorbed the fact here, that the whole of your future is entirely in your own hands. By keen enthusiasm and unselfish work your advancement will be assured and it is possible for everyone of you by such devotion to duty to rise to the highest branch of the service. You are entering the department at a very interesting stage. It is more than half a century old, and the results of the work of the department are becoming more and more apparent. Each decade now

should show marked strides forward, not only in the direction of intensity of management but also in increased revenues to the State.

I congratulate you all on your selection of the forest life for your career, as I am sure that it is one of the finest careers possible, and for an officer who devotes himself whole-heartedly to it, it brings the greatest happiness. I sincerely wish you all the greatest success and happiness."

PROVINCIAL FOREST SERVICE CLASS OF 1922—24.

The Certificates, Medals and Prizes were then presented by the Inspector-General to the following successful students :—

HONOURS.

No award.

Pass Certificate.

1. Feroz-ud-Din Rajput..	..	Kashmir State.
2 C. G. Abichandani ..	..	Bombay.
3. Syed Ahsan Abbas Zaidi	..	Hyderabad State.
4. Harnam Singh Pathania	..	Kashmir State.
5. Manzur Ahmed Kakazai	..	United Provinces.
6. Prithi Nath Deogan ..	..	Punjab.
7. Shadi Lal Vadhera ..	..	Kashmir State.
8. Shridhar Dhar ..	..	Do.
9. Raghubans Sarup Agarwal	..	United Provinces.
10. Ramesh Chandra Datta	..	Assam.
11. Mg. Tun Ngwe ..	..	Burma.
12. Abdul Rahim ..	..	Bombay.
13. Indu Bhusan Biswas ..	..	Kashmir State.
14. Vishnu Prasad Mathur ..	..	Central Provinces.
15. Kamana Krishna Biswas	..	Assam.
16. Kashi Prasad Tewari ..	..	Central Provinces.
17. Khem Chand Malhotra	..	Punjab.
18. C. J. Ferdinands ..	..	Burma.
19. Rajani Mohan Das ..	..	Assam.

GRANTED A PASS CERTIFICATE AFTER ABSENCE OF 18 MONTHS THROUGH ILLNESS AND ON UNDERGOING A WHOLE SECOND YEAR'S COURSE :—

1. Suresha Nand Nautiyal	..	United Provinces.

FAILED BUT GRANTED RANGER CERTIFICATE.

1.	Har Govind Prasad Saksena	Dhar State.
2.	D. G. Grange	Central Provinces.

RANGER CLASS OF 1922—24

HONOURS.

1.	Mohd. Sulaiman Khan	Punjab.
2.	Shambo Nath Razdan..	Kashmir.
3.	Krishna Chandra De Purkayastha ..	Assam.
4.	Raghu Bans Sahai	United Provinces.
5.	Damodar Joshi	Do.
6.	Janardhan Bapurao Shelke	Bombay.

HIGHER STANDARD.

7.	Shiva Prakash Sharma	United Provinces.
8.	Kharag Singh	Do.
9.	Amar Chand	Nalagarh State.
10.	Suresh Chandra Nath	Assam.
11.	Shanti Sarup Puri	Kashmir State.
12.	Mohammed Abdul Hamid	Assam.
13.	Sultan Sinha	United Provinces.
14.	Hira Nand Puri	Chamba State.
15.	Kailash Chandra Sharma	Punjab.
16.	Mohammed Jalil Ahmad	United Provinces.
17.	Raghbir Singh	Punjab.
18.	Prem Chand	Poonch State.
19.	Dhirendra Chandra Chowdhuri	Bengal.
20.	P. Cheryan Kurien	Bombay.
21.	Sitaram Narayan Sangle	Do.
22.	Khirode Chandra Roy Chowdhuri ..	Bengal.
23.	Nazir Ahmad	Punjab.
24.	Hari Singh Sodhi	Bilaspur State.
25.	Deveswar Neog	Assam.
26.	Miraj Uddin	Punjab.
27.	Mohamad Ali	Do.
28.	Pradhan Kashinath Sakharam	Bombay.
29.	Gian Chand Rawla	Punjab.
30.	Indu Bhusan Sircar	Bengal.
31.	Ranjit Singh	Punjab.
32.	Allah Uddin Ahmed	Bombay.
33.	Tukaram Raoji Mohite	Kolhapur State.
34.	Govind Narayan Oka	Bombay.
35.	Shankar Lal	Rewa State.
36.	Lal Chand	Punjab.

LOWER STANDARD.

37.	Hari Shanker	United Provinces.
38.	Bhudeva Prasad Sharma	Do.
39.	Kailash Chandra Rode	Do.
40.	Mohammed Yusuf	Kashmir State.
41.	Nandi Singha Monipuri	Assam.

MEDALS AND PRIZES.

PROVINCIAL SERVICE CLASS OF 1922—24.

Gold Medal for *Honours* ...	*No award* ...	...
Silver Medal for *Forestry* ...	Feroz-ud-din Rajput.	Kashmir State.
,, ,, ,, *Botany* ...	Do. ...	Do.
,, ,, ,, *Engineering* ..	Harnam Singh Pathania.	Kashmir State.
,, ,, ,, *Surveying* ...	C. G. Abichandani.	Bombay.
Hon'ble Members Prize for proficiency in all branches of *Forestry*.	Do. ...	Do.
Hill Memorial Prize for *Silviculture*.	Raghubans Sarup Agarwal.	United Provinces.
McCrie Memorial Prize for best student in *Working Plans*.	Feroz-ud-Din Rajput.	Kashmir State.
Indian Forester Prize for *General Proficiency*. (Best student who has not received any other prize.)	Syed Ahsan Abbas Zaidi.	Hyderabad State.
Inspector-General's Cup for best all-round *Athlete*.	Harnam Singh Pathania.	Kashmir State.

RANGER CLASS OF 1922—24.

Gold Medal for highest marks, with *Honours*.	Mohd. Sulaiman Khan.	Punjab.
Fernandez Gold Medal for *Utilisation*.	Janardan Bapurao Shelke.	Bombay.

Silver Medal for *Forestry*	Krishna Chandra De Purkayastha.	Assam.
„ „ „ *Botany* ...	Shambh Nath Razdan.	Kashmir.
„ „ „ *Engineering*...	Mohd. Sulaiman Khan.	Punjab.
McDonnell Silver Medal. (Best *Punjab* or *Kashmir* student.)	Do. ...	Do.
William Prothero Thomas Prize for the best practical *Forester*.	Damodar Joshi	United Provinces.
Indian Forester Prize for the best student who has not received any other prize.	Raghu Bans Sahai.	Do.

After the presentation of certificates and prizes by the Inspector-General, Mr. Perrée said that there still remained a small but important duty to perform before closing the day's proceedings. Allusion had been made in his report to the sad loss of one of the senior students by drowning. A full account of the accident and of the gallant and eventual rescue by the Provincial Forest class of three men stranded in the Tons River had appeared in the June number (1923) of the *Indian Forester*. As a result of action taken by Mr. Bourke the incident was brought to be notice of the Royal Humane Society, who had now awarded life-saving testimonials to Messrs. Simmons (Instructor) and to students Tun Ngwe, Grange, Ferdinands, Feroz-ud-din, Datta and Das. A certificate '*In Memoriam*' was also awarded to the relatives of the late Bibhuti Bhuban Sircar. The tragedy had brought out those qualities which it had been the aim of all to inculcate in the students at Dehra and to embody in the traditions of the Research Institute and College. It was a moment of which they would all feel proud although they would mourn with the relatives of their late fellow-student and friend for the loss of a gallant son.

In perpetuation of the memory of student Sircar and of the gallant incident of the rescue, a fund has been started at the Thadiar Dispensary, called the B. B. Sircar Fund, in order to provide food for those out-patients who are unable to support

themselves while undergoing treatment; this fund has been liberally subscribed to by the students and the officers of the College and Institute.

The Inspector-General was then asked to award the Royal Humane Society's testimonials.

With cheers for the Inspector-General, Mr. Perrée and Mr. Bourke the proceedings were brought to a close.

THE LATE PROFESSOR ARNOLD ENGLER.

Arnold Engler was born at Stans in 1869. He graduated at Lucerne and entered the Polytechnique in 1887, not as a forester, but he very soon transferred to the forest side. He took his forestry diploma in 1890. His first real appointment was as Inspector of Forests at Küblis in 1892, and in 1893 he became Oberförster of his Canton.

He was appointed to the Forest School in Zürich in 1896 at the age of 28 years. There he served till his death for 26½ years as head of the College and of the forest section at the Technical Institute in Zürich.

He has written numerous works and articles on Si.viculture. Perhaps his best known work outside Switzerland is that concerning the influence of seed origin on growth and the influence of forests on the flow of streams.

S. H. H.

THE LATE MR. CECIL BAGSHAWE.

With regard to the late Mr. Bagshawe, whose obituary notice appeared in the previous number of the *Indian Forester* a correspondent sends the following appreciation :—

"He first joined the Forest Department about the year 1868-69 and was a nominee of the late Sir Henry Ramsey, Commissioner of Kumaon, having been employed by him for some time, on road work, etc., and who recommended him to the late Col. Pearson for an appointment in the Forest Department then being formed.

The first years of his service were spent in the Jaunsar, where his tact and practical commonsense did a lot to help Mr. Cornwall, the Settlement Officer, in arranging for the demarcation of the forests, and also in pacifying the *Jaunsaris* accustoming them to the new Forest rules and regulations.

Later on, about 1875-76, he accompanied the Khuram Valley Expedition across the Pewer Kohat pass, where he was employed in the construction of huts for the troops.

He officiated as the Director of the Forest School during 1890 for about six months after which he went to Berar. During the great famine in Central India he did splendid work for about two years in the organisation of the famine work and supplies.

As regards his capacity for Forest organisation and administrative work I think that I am right in stating that he was perhaps one of the most successful, tactful and hardworking 'Pioneer Forest Officers' of the old school, whom the Forest Department has ever had.

Regarding his personal character, he was of a most genial, sociable and hospitable disposition, and was always on the best of terms with his staff, and with the District Officers and the Civil Service.

Soon after his retirement he suffered from the effects of a damaged leg, due to a fall from his horse in India, and in consequence of which he spent about a year in Guy's hospital in London.

During the Great War he did most valuable work in connection with the hospitals, and other war duties, and was also a J. P. of Bournemouth.

He has been in failing health for two or three years, apparently from heart weakness, and leaves a wife, but no family."

Another correspondent who served under him when he was Conservator of the old Central Circle, U. P., writes, " I should like to bear testimony to his wonderful goodness and kindness of heart. He was all the time doing kind acts to everyone around him, and he would spare no pains to help those who had the honour and pleasure of serving under him. I have heard that he inspired unbounded confidence and affection among the people in the

neighbourhood of his jurisdiction. They would crowd round him the minute he came into camp from a march, and although he must have been tired he always there and then listened patiently and kindly to what they had to say, and gave them advice. Perhaps his best work was done in Berar, but about that I have no personal knowledge. He was one of those very rare characters who gain the goodwill of an entire countryside, for whom the people will eagerly do whatever he wishes done. I happened in my early service to be quartered in a Division where Bagshawe had been several years previously, and the people were even then for ever talking of 'the time of Bagshawe sahib'. He had evidently completely swayed the whole place, and that by kindness, not in the least by severity. Those days, it must be remembered were the days when the Forest Department was comparatively new, and exceedingly unpopular by reason of restrictive measures which were of necessity, the duty of Forest Officers to carry out, measures which the people did not understand in the least. So everything was against Bagshawe, and yet no District or other officer can ever have been more beloved. Such men are worth untold gold to a Government."

CORRESPONDENCE.

NATURAL REGENERATION OF SAL.

SIR,

The enclosed extract from the Diary of the Deputy Conservator of Forests, Kamrup, for the month of February, 1924, may interest some of your readers. . . "Another legitimate cause for a certain amount of complaint is that in places, even in the villages themselves, the presence of sal spoils the village site eventually, as it creeps in and nothing will stop it, not even the yearly fires. Once it has got ahead and becomes sufficiently large, they can not fell it under the rules and so gradually we have sal creeping right into the villages themselves." . . The

area is burnt annually and lightly grazed after burning ; when the grass gets coarse the cattle stop grazing in the grass-land and graze in the tree-covered areas, where the grass is finer.

F. TRAFFORD, I.F.S.,
Conservator of Forests, Assam.

REAFFORESTATION WITH PINES AND SISSOO IN ASSAM.

SIR,

(1) I enclose photographs* of a few seedlings and saplings of *chir*, Khasi pine, and *sissoo* grown by Captain G. A. Nevill, Political Officer, Balipara Frontier Tract. This would probably be of some interest to those who read Mr. Howard's note—"On reafforestation of grassy blanks in *sal* forests" published in the *Indian Forester* of September 1923. Captain Nevill states that *chir* occurs east of Monbas and Aka country, as low as 2,500′, in the outer Himalayas. From there the seeds were brought and were sown at Charduar. The seeds of Khasi pine were brought from Shillong and sown at Lokra.

(2) The soil at Lokra is shallow, very sandy, hardly 2 feet deep, overlaying a deposit of boulders. The whole of this area was once a big grassy blank. The soil at Charduar is deep loam. The air is fairly humid, as could ordinarily be expected of country lying at the foot of hills, the rainfall at Charduar is on an average 100″ per annum. The maximum temperature rarely exceeds 93°. From December till the beginning of the rains the country is very dry. Lokra being only 2 miles away from Charduar, the climatic factors can be taken to be the same as those of Charduar.

The best Khasi pine at Lokra is about 8 years old. The height of the tree is 22′ and the girth is 1′-11″.

The best *chir* at Charduar is about 4 years old. The height of the seedling is 9′, and girth about 6″. It must be remembered

* We regret that it is not possible to reproduce Mr. Adhikari's excellent photographs.—HON. ED.

that the plants were grown as roadside trees, and as such they were not close enough to kill the side-branches and induce height-growth by competition.

(3) Two plots were selected during last year for experiments in sowing seeds of *sissoo*. Both were grassy blanks, one inside a *sal* patch and the other a little away from it. In one plot it was a complete success and in the other the result was most disappointing. We also tried transplanting by root-and-shoot-pruning method, but the result does not seem to justify the expense and trouble. Direct sowing is by far the best and is sufficiently certain to warrant recommending. The result of our experiment in the main coincided with that obtained by Mr. Howard.

(*i*) That the soil preparation makes a world of difference assuming that the plots are selected in suitable localities. At each stake the soil should be properly and deeply hoed and clods broken. It should also be cleared of all grass roots, so that the tender seedlings may not get choked up just after germination by the simultaneous sprouting of grass.

(*ii*) That the time of sowing should be so chosen that drought may not harm them at least within a month of their germination. This can be avoided by waiting till the break of the monsoon rain.

(*iii*) At least 2 weedings would be necessary. Grass must be kept down so that the seedlings may not get choked up and that plenty of overhead sunlight is admitted.

(*iv*) By the end of November grass must be cut down and removed. Sufficiently broad fire-lines should be cut round the plots to prevent spreading of fire inside the plantation as these grassy blanks are subject to conflagration every year.

(4) A 2-years-old *sissoo* seedling about 14′ high and 10″ girth was grown from suckers, by the Jailor along the Jail road of Tezpur. Its fine growth shows the suitability of this species in many parts of this District. The value of this tree in this part

of the province is enormous. A few months ago a road-side *sissoo* tree at Gauhati about 65 years old fetched Rs. 150. The other day a *sissoo* about 60 years old fetched Rs. 100 at the Head-quarters station of Darrang District. Is not this a fair indication that it would be worth paying more attention to making *sissoo* plantations, and afforesting the accessible grassy blanks of Reserves,—which unfortunately are too many in this District—instead of trying with species of doubtful or less marketable value ?

A. K. ADHIKARI, P.F.S.,

Tezpur, Assam.

REVIEWS AND EXTRACTS.

THE EDINBURGH UNIVERSITY FORESTRY SOCIETY.

The fourth number of *Sylva*, the annual publication of the Edinburgh University Forestry Society contains articles and letters from foresters from various parts of the Empire, *e.g.*, "Problems of Forest Conservancy in the Gold Coast," by D. Hendry; "Counter Erosion Work in the Punjab," by Macwagon; "The effect of Fire on Regeneration," by H. S. D.; "The Submerged Forest on the Coast of Lincolnshire," by N. S. Stevenson. R. C. Fisher writes on "Forest Entomology in Britain." George W. Somerville deals with minor products under the title of "The Forest Medicine Chest." M. H. S. contributes "Some Notes on Artificial Seasoning of Timber," and H. M. Steven an appreciation of Archibald Menzies and David Douglas. Accounts are given of "The Advanced Course in France, 1923," "Cours pratique en France après le diplôme" and the "Practical Course, Dunkeld."

Under the pertinent question of "Where did that one go to, 'Erbert?" notes are given on the movements of Edinburgh Foresters.

THE EMPIRE FORESTRY ASSOCIATION.

The latest number of the *Empire Forestry Journal* (Vol. II, 2nd December 1923), is largely devoted to the Canadian Tour of the second Empire Forestry Conference, as may be gathered from the following articles: "Impressions of Canadian Forestry," by A. C. Forbes; "Silviculture in Canada," by C. D. Howe; "Forest Fires in Canada," by D. Roy Cameron; "Canadian Insect Problems," by J. W. Munro; "Softwood Resources of Canada," by R. D. Craig. A detailed account of the tour is provided by R. S. Troup.

The softwood resources of the United States are dealt with by W. D. Greeley, and those of Europe by Fraser Storey. W. A. Robertson describes India's foreign timber trade, and Sir James Calder deals with the timber trade of Europe. J. R. Ainslie makes suggestions for marketing tropical timbers. A review of Indian forest management is supplied by C. G. Trevor. Thomas Thomson gives an account of a Douglas fir plantation in Wales.

It will be remembered that at the conference it was resolved, that the *Empire Forestry Journal* should be the medium for the publication of official and technical information and that, pending the formation of an Empire Forestry Bureau, this information should be prepared by the standing Committee on Empire Forestry assisted by technical correspondents in all the Forest Departments of the Empire.

We understand that professional foresters may become members of the Association at a reduced rate of subscription, which will entitle them, among other privileges, to receive this valuable Journal regularly.

REAFFORESTATION IN CHINA.

There is no substitute for forestry as a factor in the permanent prevention of famines in China. The reforestation of her millions of unwooded acres alone will not prevent famines, but there can be no permanent prevention without it.

China's forests are spent, her hills are denuded, an adequate supply of forest products is lacking. Modes of living have had to be adjusted. Her agriculture has been forced to assume responsibility for furnishing fuel to her population, in addition to food and clothing, making impossible the replenishment of the supply of organic matter in the soil. Fertility and production have been lowered.

The season's rainfall has been dissipated in riotous run-offs, causing ruinous floods. Stream beds on one hand are all but dried up, there being little or no supply of ground water to replenish them by slow regular seepage, while other streams are silted up, unable to carry off the load of soil that has been brought to them from the barren, unproductive hills. Destruction of life and property, and untold suffering have resulted. "Beware of mountain water" read signs in many canyons in China, posted as a warning to travellers against the sudden rise of torrents during storms. Agriculture for many has become an all too hazardous occupation.

The people are affected not only economically, their productive efficiency being lessened, but they have suffered physically and socially as well, where their forests are gone.

After centuries of neglect, China last year spent about $250,000 in forestry work—planted about 1,000 nurseries, reforested about 100,000 acres of otherwise useless land and, produced about 100,000,000 young trees. About one-quarter of her 1,800 districts have forest nurseries for the upkeep of which they are taxed. Several of the provinces have developed Provincial Forest Services. Arbor Day is increasing in popularity, and its observance is being greatly extended each year. Forestry education is being rapidly developed, until there are now not only forestry schools, but forestry is taught in many of the secondary, particularly the agricultural schools.

These facts indicate clearly that China is making progress in her forestry development, that she is beginning to appreciate the need of reforestation and the relation of forests and forest

products to her national life.—[*Prof. John H. Reisner, University of Nanking* in *the Australian Forestry Journal, June 1923.*]

DURABILITY OF TEAK.

At the Bombay Engineering Congress Mr. Wright produced pieces of teak from Bijapur at least 370 years old, which he had tested for transverse strength. In the well-known formula $P = \frac{W \times L}{B + D^2}$, the value of P in the case of modern teak varies from 467 to 953, and 600 is a normal figure. Mr Wright found that his old specimens of teak, light in weight by age, had a P = 875, showing how little time had affected its strength. But 370 years are nothing for teak in favourable conditions. Dr. A. H. Sayce, the Assyriologist, records beams of teak, still undecayed, at Ctesiphon, dating from the sixth century, and in India the teak ribs of the Buddhist *datiya* at Karli may possibly date from some years B. C.—[*Indian Engineering, December 29th, 1923.*]

COUNTER-EROSION WORK IN THE PUNJAB.

Of the many queer tracts of country which man in his temerity has tackled under schemes of reclamation, perhaps the most uncouth and unprofitable are the Pabbi Hills, which form an extension of the Himalayan foothills out into the flat expanse of the Punjab plain. The main ridge of these hills, whose highest points are some 1,300 feet above sea level and 600 feet above the neighbouring plains, runs for about 20 miles parallel with the Jhelum from the point where that mighty stream emerges from the real foothills of the Himalaya.

"Pabbi" is actually the Punjabi for any high, broken ground and certainly it would be difficult to imagine anything more derelict than this geological rubbish-dump with its tumbled ravines of bare earth. The railway line and the Grand Trunk Road from Lahore to Rawalpindi cross the range, and the traveller gets a view of rugged slopes clothed scantily with thorny *phulai* scrub, with here and there a cliff of bare rock or a steep scree of loose red

clay-shale. But both the road and the railway run through the reclamation area where work was started forty years ago by the Forest Service, and one has to climb up to a higher view-point to appreciate the comparative greenness and solidarity of the old "plantation area" compared with the devastation of the unclaimed ravines. It requires no impressionist to realise that this part of the world has "gone bad," and that the whole range is being carved out afresh and washed away by each monsoon deluge.

Originally, as far as one can judge, the range was a continuous undulating plateau of savannah or forest land formed geologically by a slight synclinal fold in the carboniferous sandstone series which immediately underlies most of the alluvial plains of the Punjab. In this fold the sandstone has been raised some hundreds of feet above the present level of the plains, and with the natural processes of erosion the upper layer of soft and friable stone has been partly worn away. Beneath it lay a much more vulnerable series of clay shales and sand, and wherever these were exposed, undercutting and ravining set in, until the whole area is now a series of islands of the original plateau separated by deep gorges and linked up by incongruously carved and top-heavy ridges of disintegrated rock. The rainfall average is about 25 inches but more than half of this falls in a few hours during the torrential monsoon storms of July and August, when literally millions of tons of sterile silt are washed down on to the zamindari fields below. The chief danger lies in the fact that the Upper Jhelum Canal skirts the base of the range, and throughout the twenty miles, each torrent which flows towards the Jhelum River has to find a passage under the canal bed through a masonry "syphon" tunnel. The canal was built in 1912—15 as part of the magnificent Triple Project for pooling the available water of the three great rivers, the Jhelum, the Chenab and the Ravi, to supply the various canal colonies. So far, the engineers' calculations for these torrent escapes have proved adequate, but the erosion in the unreclaimed areas is annually getting worse, and if a single syphon were to become choked, the arrested torrent would almost certainly force a breach in the bank with consequences that would spell disaster and suffering for the canal colony away to the southward. To the

east, on the Chenab side, many of the torrent beds, which during most of the year are dry wastes of sterile sand between the fields, peter out before they reach the river, for the water is trapped by the cultivators by making earth "*bands.*" In many cases the silt has appreciably reduced the fertility of the soil, and in others the actual ravining processes are spreading out into the plains and many fields have been rendered useless for ploughing.

The history of the counter-erosion work is available in the old Range Journal, which contains everything from the strafes of visiting conservators, including a visit from the redoubtable Ribbentrop when he was I.G.F., to a wordy warfare in multi-coloured inks between a verbose ranger and an equally incompetent D.F.O., whose pen was much more active than his feet! For anyone who has been caught by the fascination of the loneliness of this No Man's Land with its gaunt ravines and uncouth earth carvings, the Journal makes most interesting reading. The continuity of the scheme of work was occasionally broken, such as when a conservator came to the conclusion that the Pabbi could very well look after itself and proceeded to allow it to do so for an interval of years. During most of the time, however, experiments with new tree species were going forward, and out of more then forty species which have been tried, only two could be called reliable in this inhospitable region. Of these, the *phulai* (*Acacia modesta*) is of desperately slow growth, reaching a height of 14 feet and a diameter of 3 inches in thirty years, after which it dies off—and *walaiti jand* (*Prosopis glandulosa*) which grows slightly quicker, but which is hardly saleable even as fire wood. Some of the better timber species such as *shisham* and *kikar* have done quite well in the ravine bottoms, where they got a certain amount of shelter and moisture.

Of the various methods which have been used for checking the erosion the original scheme of building low "dry stone dikes" across the V of the ravine channels and along the foot of unanchored screes, has proved the most useful. The value of these walls can easily be seen to-day where subsequent erosion all around has isolated them and their load of earth. Now, of course, the cost of daily labour is three or four times what it was when

these walls were built, and at the moment the "economists" among the Indian politicians are so active that it is impossible to get large sanctions to extend the reclamation area. Within the last three years, however, some fresh work has been started, the main scheme of which is to waylay the silt building very solid earth "*bands*" or embankments across the ravines, thus stopping the rush of water and allowing it to drain off through a side escape. The water dumps its load of silt in the "tank" thus formed which fills up gradually with silt. Enough water is held back to form a reserve of moisture which enables many tree species to prosper on these *bands* which would not even germinate under the ordinary dry conditions of the area. The ravine bottoms are being sown with shisham and the plateau tops are being ploughed up between the existing rows of *phulai* and *Prosopis* in order to reduce the run-off and improve the grass growth. "Contour trenching" is also being carried out on all the less precipitous ravined slopes ; lengths of a few feet are dug out and seed is sown along the berm, thus a small reserve of moisture is held back for the plant when it germinates in the rainy season and the precipitate rush of the surface drainage is checked to some extent by the trenches.

During the drought years of 1920-21, the whole area was opened for grazing, and it is as a fodder reserve for bad years that the Pabbi must be treated from the point of view of forest policy. It is not so much in the production of timber as in the reclamation of larger areas for a fodder reserve that our hopes of future usefulness lie, and if the Forest Department were given sufficient scope, the remainder of this unprofitable wilderness and many similar waste areas in the Province could be made to form a spendid reserve against the "lean years" which periodically bring so much hardship to the agricultural districts.—[*Macwagon in Sylva, No. 4, 1923.*]

JAVANESE TEAK.

The Amsterdam correspondent of the *Manchester Guardian*, in a report on the Dutch East Indies, states that the number

of large enterprises in which both private and Government capital participates is increasing in the Netherlands Indies. Since the establishment of the Nederl.-Ind. Aardolie Mij. (Dutch East Indian Petroleum Co.) for the exploitation of the Djambi fields, in which the Royal Dutch and the Government are interested, the plan for the erection of a blast furnace enterprise with the participation of the Government has now been accepted by the Indian National Council.

It is very probable adds the correspondent, that a similar collaboration will come about in the timber trade. The National Council has given its consent to such a scheme. It is noteworthy that this latter scheme does not emanate from the Government but from private quarters.

Owing to the fluctuating prices and the unfavourable conditions of the market, the big "*djati*" (Java-teak) enterprises have been unable to make their businesses pay during the past few years, while the Government instead of having 200,000 cubic metres of timber cut in its forests as in normal years, had in 1923 only 75,000 cubic metres cut. The Government is to secure participation in the capital of several timber trade enterprises by obtaining preference shares, not, however for cash, but as a partial return service for the contracts concluded with the various concerns. To these the timber (up to 30 per cent. of the total yield of the Government's forests) is ceded at a very low price.—[*Timber Trades Journal, Vol. XOV, No. 2473.*]

THE AERIAL SURVEY OF THE IRRAWADDY DELTA FORESTS.

The success of the aerial survey of the Irrawaddy Delta carried out by Mr. Kemp and the officers under him may be gathered from the fact that whereas it was originally intended that only 1,000 square miles should be surveyed, it has now been decided to extend the area to 1,350 square miles. The achievement is the more remarkable because many difficulties had to be overcome, not the least of them being the late arrival of

supplies and the conversion of the two D. H. 9 machines into seaplanes, fitted with floats specially designed by Mr. Kemp for their work. As a matter of fact practically only one of these machines has been used, and it has flown 110 hours, representing a distance of about 10,000 miles, during which 3,000 plates have been exposed. The photographs are said to have shown a high percentage of accuracy, with little or no variation of scale throughout the whole area, and the detail is so exactly reproduced that the Forest Department are believed to be considering the possibility of counting individual khanzo trees—a larger type of tree abundant in the delta—by means of the photographs. Mechanical troubles have been comparatively few, the chief of them being the failure of the magneto occasionally owing to "the shellac melting on the armature and throwing itself off until it caused the whole to seize up between the poles" Mr. Kemp carried out all the test flights, but the actual piloting has been performed by Major Cochran-Patrick. The photographic work has been in the charge of Flying Officer Durward, who has had considerable experience in India and Iraq, and whose service have been lent to the survey by the Royal Air Force.—[*The Pioneer 12th April 1924.*]

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WHAT IS *THE* LAC INSECT?

The question whether the production of commercial lac is due to several species of *Coccidæ*, or to many varieties or strains of a single species, is one that has remained unattended until quite recently. Although the problem has long been investigated by specialists, it is only within the past two years that the results of their labours have been published. It is the object of this article to draw attention to some notable contributions to the subject.

E. E. Green completed the fifth volume of the "Coccidæ of Ceylon" in 1922, and thereby provided one of the best existing accounts of the group as found in Ceylon. J. C. Chamberlin published a "Systematic Monograph of the Tachardiinæ or Lac Insects" in October, 1923 (Bull. Ent. Research, XVI (2), pages 147—212) in which the lac insects of the world are exhaustively treated. S. Mahdihassan, approaching the subject from another aspect, produced in the same year a paper on the "Classification of Lac Insects from a Physiological Stand Point", (Journ. Sci. Assoc., Maharajah's College, Vizianagaram, I (2, 3) pages 47—99). A paper by the same author on the life-cycle of south Indian Lac insects appeared in the *Indian Forester* for December 1923, pages 653—663. The Agricultural Research Institute, Pusa, has issued a thoroughly revised edition of its Bulletin on the cultivation of lac in the plains of India by C. S. Misra (Bull. 142, 1923). And lastly T. D. A. Cookerell proposed further changes in nomenclature in February, 1924 (Psyche, XXXI (1), pages 47—48).

The term "lac insect" is extended to include those scale insects (*Coccidæ*) that produce a hard, more or less resinous secretion, soluble in alcohol, which completely envelopes them in the form of separate cells or of a continuous incrustation. They are grouped together into a sub-family, the *Tachardiinæ*. It has been shown as a result of chemical analysis that the lac secreted by the American genus *Tachardiella* is almost identical in composition to that of the Oriental *Tachardia*. And while an analysis has never been made of the lac of *Austrotachardia*, in all respects it seems to behave as a true lac. The tests of the Oriental genus *Tachardina* on the other hand are of a hard substance resembling gutta-percha (Chamberlin).

Mahdihassan attempts to answer the question "What is meant by Lac"? and comes to the conclusion that the Indian forms may be assigned to two groups, the true lac insects (to which he gives the name *Lakshadia*), and the pseudo-lac insects (to which the name *Tachardia* is restricted). True lac insects produce a secretion with resinous properties, which melts with heat and may be drawn into a thread, and with alcohol forms a viscous varnish. The pseudo-lac insects produce a secretion like hardened gelatine rather than a brittle resin, which melts like butter with heat and does not draw into threads; with alcohol the substance swells up leaving a large insoluble residue. There are also morphological differences. While his separation of the two groups is practical, the names proposed by Mahdihassan cannot be adopted, as *Lakshadia* automatically falls as a synonym to the older *Tachardia* (being based on *Tachardia lacca* or new species congeneric with it); and *Tachardia* as applied to the pseudo-lac insects is congeneric with *Tachardina*.

Disregarding the pseudo-lac insects we may now consider more closely the true lac-producing forms.

Tachardia albizziæ, according to Green, produces a lac which is the principal material employed in the lac industry of Ceylon.

T. (Metatachardia) conchiferata, known only in Ceylon, where it is less abundant than *T. albizziæ*, but produces a much superior lac.

The species of lac insects found in India are given in the annexed table, which correlates the opinions of the authors mentioned above as to the specific and generic limits of the forms :—

THE INDIAN SPECIES OF LAC INSECTS.

Green, 1922.	Chamberlin, 1923.	Mahdihassan, 1923.	Cockerell, 1924.
Tachardia albizzia Green =	*Tachardia albizzia* Green =	*Lakshadia albizzia* Green =	*Laccifer albizzia* Green.
(,, *fici* Green) =	,, *fici* Green =	,, *ficii* (*sic*) Green =	,, *fici* Green.
	,, *ebrachiata* Chamb. =	... ... =	,, *ebrachiatus* Chamb.
,, *lacca* Kerr =	,, *lacca* Kerr. =	(*Lakshadia indica* Mahdihassan ,, *nagoliensis* ,, ,, *sindica* ,, ,, *chinensis* ,, ,, *mysorensis* ,, ,, *communis* ,,)	= ,, *lacca* Kerr.
,, *conchiferata* Green	*Metatachardia conchiferata* Green =	... ... =	,, *conchiferatus* Green.
Tachardia minuta Green (nec Morrison) =	*Tachardina ternata* Chamb. =	... ... =	(*Tachardina ternata* Chamb.)
	,, *lobata* Chamb. =	*Tachardia minuta* ,, = (nec Morrison) ,, *silvestri* ,,	,, *lobata* Green.

Tachardia fici, known only from Monghyr in India, gives a pale lemon-yellow lac like that on *Butea frondosa*; the colour of the alcoholic solution is also similar.

Tachardia ebrachiata, according to Chamberlin, forms a lac that is very much lighter in colour than that of *lacca*, being a clear reddish-orange.

The insect described by Kerr in 1782 as *(Coccus) lacca* has always been regarded as scource of the commercial product known as shellac, and it will be seen from the table that Green and Chamberlin agree in regarding *lacca* as one homogenous species in which they are supported by Misra, Cockerell and many others, whereas Mahdihassan splits it up into at least six species.* Green holds the more conservative opinion as to the morphological variability possible within the limits of the species *lacca*. He considers it a peculiarly polymorphic species, of which the extreme forms might well be regarded as species, if the connecting links were unknown, and is inclined to rank his *Tachardia fici* as merely an extreme form of *lacca*. Chamberlin, on the other hand, maintains *fici* as a distinct species and further-more separates from *lacca* the closely-related *ebrachiata* on well marked characters. Mahdihassan considers that morphological characters alone are insufficient for the classification of lac insects, and maintains the physiological standpoint should be taken, as these two aspects of the study are mutually dependent. From a study of the micro-organisms associated with lac insects; the appearance, composition, solubility and amount of the lac secreted; the food-plaints; the number of broods, etc., he considers that there are in India eight forms of true lac-producing insects, that deserve specific rank. For six of these he proposes new names, *viz.*, *indica*, *nagoliensis*, *sindica*, *chinensis*, *mysorensis*, *communis*. Unfortunately these names are not accompained by any recognisable morpholcgical description, and are therefore *nomina nuda*, or names of no account in entomology. To the cultivator of lac, however, they have at least a value as indications of definite forms or strains of the commercial lac insect *Tachardia lacca*.

* In 1919 Misra was of opinion that there are a number of species of lac-insect and of which *T. lacca* is one (Proc. Third Ent. Meetin Pusa 1919, II, p. 799.

They are recognisable by the following characters :—

1. '*Indica*".—A lemon-yellow lac on *Butea frondosa*, only likely to be mistaken for that on *Schleichera trijuga*. Alcoholic solution lemon-yellow.
2. " *Nagoliensis*".—A thick lemon-yellow lac on *Schleichera trijuga* with a slightly opaque lemon-yellow solution in alcohol.
3. " *Sindica* ".—A distinctly yellow lac on *Acacia arabica* in Sind.
4. " *Chinensis* ".—A dark or yellowish-chestnut lac found in Assam, Indo-China, and possibly Burma and S. China.
5. " *Mysorensis* ".—A still darker or yellowish-chestnut lac on *Shorea Talura* in Mysore that grows well on *Nephelium Litchi*. The insect is the smallest of all forms and is trivoltine.
6. " *Communis* ".—The darkest lac, chestnut, garnet or ruby coloured on *Ficus mysorensis*, *F. bengalensis*, *F. religiosa*. *F. Bengamina* and on *Albizzia Lebbek* in various parts of India ; also grows well on numerous other trees. Alcoholic solution is tea-coloured.

These grades of colour among stick-lac have been more or less clearly recognised for ages, and have given rise to much speculation as their conspecific identity. Beyond speculation the matter has not progressed. At the Agricultural Research Institute, Pusa, is a collection of different grades of cultivated and wild lac, wet and dry, that has been made from all lac-producing areas in collaboration with forest officers, but it still awaits working up. At the Forest Research Institute no research on the lac insect has been done since 1912. The studies of Imms and Chatterjee published in 1915 (Ind. For. Mem., III, I) were confined to the biology and natural enemies of *Butea* lac only.

It is evident that experiments of a very simple nature could determine if the various grades of stick-lac are due primarily to the host-tree or to the insect, and if the characters are stable and transferable from one species of tree to another. Mahdihassan points out that the colour of the gum or sap of the host-tree does not necessarily influence the colour of lac. The darkest lac occurs

on species of *Ficus*, which have a white latex ; the next darkest lac occurs on *Shorea Talura*, that has a glassy white resin.

Cross-inoculation, as a test for the stability of characters or powers of adaptation, has been relatively neglected by investigators. For example, it is generally believed that when lac from *S. trijuga* is transferred to *B. frondosa*, the first crop resembles that of the parental lac, and the subsequent generations gradually take on the character of *Butea* lac. As Mahdihassan points out, if the belief cited is a fact, then both *Schleichera* and *Butea* forms must be regarded as belonging to one species with great powers of variation due to nutrition; but as the *Butea* insect does not establish successfully on *Schleichera* it must be credited only with powers of degenerative adaptability. Using the same line of argument, he considers wild lac on *Shorea Talura*, *Ficus mysorensis*, *Pongamia glabra*, and *Ixora parviflora* to be formed by four distinct species, because they show no degeneration or approach to one another in morphological or physiological characters, when grown on a common host-plant. The peculiarity of the trivoltine lac insect on *Shorea Talura* (*i.e.*, three crops in 13 lunar months) has been successfully transferred to two other host-trees, *Butea frondosa* and *Acacia Farnesiana*.

Host-selection or preference for a particular form of food is not peculiar to the Coccidæ. Other insects with polyphagous habits as far as the species is concerned, develop strains or varieties, which, by continual breeding on one host-plant, become restricted to that host entirely or transfer to another only with difficulty. It may be said that from the economic aspect of the problem, the lac-cultivator in not assisted greatly by the knowledge that *Tachardia lacca* is on the one hand a single species, or is on the other hand a group of morphologically similar species. However, in regarding it as one species he will be supported by the majority.

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THE ANTISEPTIC TREATMENT OF TIMBER IN INDIA.

Timber is so well-known to most people that very few ever realise how important it is, and what a tremendous part it really plays in the world's affairs. Still less do they realise the amount of labour and thought entailed in bringing it into the form in which they are familiar with it.

So casually is it regarded by the average individual, that the thought of conserving the supply, or economically utilising that which is at his disposal, does not occur to him spontaneously, but is generally borne in upon him by some outside agency.

Economic pressure since the Great War has become so acute in most parts of the world, that we are now realising more than ever, that our resources must be put to the best economic use, and the problem of the prolongation of the life of timber has become even more pressing,—its solution more urgent.

This problem is not by any means a new one for the art of preserving timber from decay was known to the Ancient Greeks and the Early Egyptians more than 3,000 years ago.

Throughout the ages numerous devices have been brought into use to obtain the desired effect, and the number of patents taken out within the last 30 years covering solutions and devices for preserving timber is legion.

Of those preservatives which have stood the test of time the following are the most important: (1) Creosote, (2) Zinc Chloride (Burnettising), (3) Copper Sulphate and (4) Arsenic and Sugar Solution (Powellising).

(1) *Creosote.*—The name Creosote was originally given to the heavy distillate derived from the distillation of Wood Tar, and was used by Moll as far back as 1835 for the preservation of timber. The use of this substance however has been dropped in more recent times, and the word Creosote is now more popularly applied to the oil obtained from Coal Tar.

It is one of the best and most efficient antiseptics for Wood Preservation known, but is unfortunately rather expensive.

Its use mixed with heavy Petroleum or Residue Oil is now, however, becoming popular and is a better economic proposition.

(2) *Zinc Chloride* is a powerful antiseptic and has given very good results in Europe and America, when used in comparatively dry areas. It suffers from the disadvantage of being soluble in water and hence becomes washed out of timber in wet localities.

(3) *Copper Sulphate* is dearer than Zinc Chloride and also suffers from the disadvantage of being very soluble in water. Although still used in Europe it is gradually dropping out of use.

(4) *Arsenic and Sugar Solution*, a comparatively modern innovation has undoubtedly given excellent service in this country and Australia; it has the great advantage of being relatively cheap.

Considering the wealth of timber in the forests of India and the growing demand for it in the country, coupled with the fact that many timbers are readily attacked by white ants, it is not surprising that efforts are being made to gather data concerning their durability after treatment for the purpose of railway sleepers.

If the whole of the railway track in India were laid on wooden sleepers, many hundreds of thousands of sleepers would be required annually for the purpose of replacements. As it is over 4,200,000 wooden sleepers are purchased annually, which are naturally durable and give from 15 to 20 years' service, and as considerably larger quantities are required the present supply of durable sleepers is not sufficiently great nor is their cost sufficiently low to warrant their exclusive use.

It is therefore apparent that some effort must be made to utilise the naturally non-durable timbers by subjecting them to some process, which will prolong their life and at the same time be economically sound.

This problem in utilisation has also a bearing on silviculture for if the so-called "Jungle woods" which are at present not utilised can be made valuable for the purpose of railway construction or other purposes, their removal from the forests to make room for more valuable species will more than pay for itself.

With this end in view experiments were undertaken by the Forest Economist about twelve years ago to determine whether

a few selected species which are naturally not durable, could be brought into use. The progress of these experiments was recorded in Indian Forest Records and brought up to date in Forest Bulletin No. 53 of 1923, and has amply demonstrated that all the species treated can be readily utilised.

To give one instance *Terminalia tomentosa* or *sain*, a very hard wood, and eminently suitable for sleeper purposes on that account, which untreated only lasts about five years, gives a life of more than twelve years when subjected to a preservative process at an additional cost of about 25 per cent. of its original value.

The species originally treated were few in number and were mostly treated by soaking the timbers in an open tank containing the preservative. It is now proposed to experiment on more than fifty different species by treating them with different antiseptics under pressure.

From the result of past experiments it would appear that the most likely antiseptics for use in India are (1) Creosote mixed with residue or fuel oil and (2) Powellising solution, and these will be the chief preservatives used.

The plant in which the experiments will be carried out consists essentially of a cylinder closed at one end and having a door at the other. This door when closed is clamped in position and renders the cylinder water-or oil-tight under a working pressure of 180 lbs per sq. in. The cylinder is capable of withstanding a working pressure of 200 lbs. per sq. in. and has been tested to 300 lbs. per sq. in.

Below the cylinder is the service tank which holds the supply of antiseptic, which is to be forced into the wood and on the same level as the Pressure Cylinder are two cylindrical storage-tanks containing the reserved supply of preservatives.

The plant is fitted with a hydraulic pressure-pump and an air-pump worked off the same shaft by means of an electric motor. The hydraulic pump pumps the antiseptic into the cylinder when the timber is in position and puts on the pressure to force the preservative into the wood. The air pump is so arranged that

it can create a vacuum inside the cylinder or compress the air inside it.

In addition also there is an elevated tank capable of withstanding 100 lbs. pressure for use with the Rueping Process.

There are four main processes employed for impregnating timber under pressure (1) Full Cell, (2) Lowry or Empty Cell, (3) Rueping, (4) Boiling in.

In the *Full Cell Process* after the wood has been put in position in the cylinder a vacuum of about 20″ is drawn inside the cylinder and kept up for about ¾ hour. Without breaking the vacuum, oil is allowed to enter the cylinder from the service tank until the cylinder is full. The vacuum is then broken and oil allowed to run into the wood to fill the cells which have been evacuated of air. The cylinder is then filled by means of the pump and entirely closed. More oil is afterwards forced in by means of the pressure pump. Obviously, if the antiseptic is forced in at a greater rate than the wood can absorb it, the pressure will rise accordingly. The rate of forcing in antiseptic is thus regulated so that the pressure builds up slowly. When sufficient preservative has entered the wood, as calculated from measurements on the service tank, the pressure is released and the antiseptic returned to the service tank. A final vacuum is then applied to remove surplus preservative from the surface of the timber and the process is complete.

In the *Lowry Process* no initial vacuum is applied but the cylinder is filled with antiseptic fluid after the wood has been put in position and the cylinder closed. A further supply is forced in under pressure as before and when sufficient fluid has been injected the pressure is released and the fluid returned to the service tank. A final vacuum of about 20″ is then applied for about ¾ hour, when the air in the cells is withdrawn bringing antiseptic with it. The cell walls are thus left with a preservative coating but the cells themselves are not left full of antiseptic as in the Full Cell Process.

In the *Rueping Process* an overhead pressure tank is necessary. This overhead tank contains the preservative liquid, and air-

pressure is built up both in the overhead tank and in the cylinder where the wood is in position. The oil is then run into the cylinder by gravity without releasing the air-pressure, the air being transferred to the overhead tank at the same time. The cylinder is then closed and pressure applied as in the other processes. When the impregnation is sufficient the pressure is released; the air under pressure in the cells being released and so forcing out surplus fluid.

In addition a vacuum is applied which has the effect of further emptying the cells. They are thus left much freer of antiseptic than in the previous processes.

In the *Boiling Process* the timber in the cylinder is covered with antiseptic and the whole heated by steam while a vacuum is applied. Moisture in the wood thus evaporates below its boiling point while no damage is done to the timber by overheating. After a more or less lengthy period of boiling which helps to season the timber the vacuum is broken and the process completed as in the Full Cell Process. According to the present programme of work it is proposed to determine for as many species of Indian timbers as possible the amount of preservative which can be got into them and to draw up specifications for their treatment. For this reason the plant to be used is capable of working all the best processes and is fitted with instruments for recording temperature, pressure and vacuum, wherever such data may prove useful.

It is anticipated that the present programme alone will take some years to carry out and when completed will provide exceedingly useful information for the railways and commercial firms generally who may be interested in the subject on a larger scale.

In addition investigations will be undertaken to answer enquiries which it is hoped will from time to time come from various sources.

The object of such experiments are twofold, namely, (1) more intensive utilisation of non-durable but otherwise strong serviceable timbers and (ii) to help to solve the problem of wooden Railway sleepers in India. The corollary to (i) is increased revenue to the State and permitting the adoption of more inten-

sive methods of management in our forests, and to (ii) the adoption of Indian as against imported sleeper woods by Indian Railways.

J. H. WARR,
Officer in Charge, Wood Preservation.

FOREST RESEARCH INSTITUTE,
Dehra Dun.

THE TAUNGYA SYSTEM IN CACHAR DIVISION, ASSAM.

The introduction of artificial reproduction in this Division had been under consideration for some years. The existing type of forest,—mixed evergreen and bamboo,—yielding on an average approximately one mature tree per acre, is extensive in area and has yielded in the past a good revenue without much more outlay of expenditure other than that involved in the upkeep of revenue stations on river-banks. Continual skinning of the forest within easy elephant dragging-distance of the banks of rivers without any silvicultural improvement to the growing stock brought the Forest Department to realise that the previous state of affairs could not continue indefinitely, and that the ever-decreasing revenue must in course of time diminish to such an extent, that it would no longer pay to maintain a large staff of Forest Officers working only in revenue stations, merely to tax the timber trade. Accordingly in 1921 the present Conservator gave orders to start planting out teak under the taungya system. There were certain difficulties to contend with, namely, the lack of knowledge and the disinclination of subordinates, accustomed only to revenue station work, to turn out and tackle real forest work; the absence of suitable communications through the forests; and the natural suspicion with which jhuming hills-people view any innovation. This involved a good deal of extra trouble for the Divisional Officer, who had to supervise everything in person, and also to train his subordinates for the work. On the other hand, the land-hunger caused by the ever-increasing population of this district induced some of the local Cacharies, Kukies, Lushais and Tipperahs to accept

Fig. 1. A two-year old teak taungya with *Macaranga* sown between the lines : Cachar Division. Assam.

Fig. 2. A two-year old teak taungya ; Cachar.

Fig. 3. A four-year old teak plantation Cachar.

Photos by C. J. Rowbotham, I.F.S.

the Forest Department's terms. In 1920, 5 acres were planted up with teak after cutting and burning the jungle, under the three methods, *i.e.*, root and shoot-pruning, planting entire with balls of earth, and without. The rapid growth of the teak under the first method, as compared with the other two, left no doubt as to the quickest way of raising the teak above the *Eupatorium* (Giant aggeratum), which in the last ten years has invaded and spread over the open waste spaces of this district.

In the year 1922-23 about three acres of *tillah* and low land at Loharbund, and six acres at Salgonga were jhumed by Tipperahs and Kukies for cultivation of *makai* (maize) and paddy. These areas were planted up 30′ × 8′ in May with teak seedlings which had been germinated from Burma teak seeds in the previous March, placing four seedlings 2 feet spare in a square at each stake, while the low land was planted up 30′ × 8′ with *jarul (Lagerstræmia Flos-Reginæ)* after reaping their paddy early in the cold weather. The high ground was sown with cotton by the jhum cultivators. The placing of four seedlings at each stake gave excellent results, as it prevented the young teak from being overcrowded by the paddy. In March of the following year the jhumiahs continued their cultivation ; *kachu* or ginger was put out, in addition to the cotton. Surplus teak plants at stake in the original 30 lines were utilised after being root and shoot-pruned to plant up intermediate lines 10′ apart. In places *Macaranga* seeds were sown between the lines of teak in the second year, and, as the accompanying photograph shows, the *Macaranga* is likely to be useful in preventing the incursion of *Eupatorium* and as a nurse for the teak. The average height of the teak after two years' growth was six feet, except where it was retarded by insufficient weeding by subordinates during the rains, and in many cases the height-growth was considerably more, reaching in some cases to eighteen feet, as shown in another photograph.

In the second year of taungya working, *i.e.*, 1923-24, all subordinates at revenue-stations were made to visit the taungya areas in turn for periods of several days during the planting and weeding season, while those regularly employed in Forest

Beats on taungyas and mixed species plantations had by this time acquired useful knowledge as regards the germination of teak, and the more important of the evergreen species, and plantation work, and in some cases showed commendable keenness for their work.

The lack of paths and roads in the forests of this district has been dealt with by settling a number of new forest villages in low-lying areas in the Reserve for doing earth-work, and every year several new forest villages of hillmen are being started, who, after being given time to build their houses and arcielowland for permanent cultivation, are employed for teak taungyas in accessible places near streams and rivers. In 1923-24 additional areas totalling 29 acres were brought under taungya cultivation, the spacing of plants being as before 30′ × 8′. The surplus teak plants from the nurseries of 1922-23 were utilised after being root and shoot-pruned ; unfortunately all the teak seeds sown in March 1923 turned out to be bad and failed to germinate. In some of the taungyas the original 30′ × ′8 lines had to be stocked with mixed species *jarul (Lagerstræmia Flos-Reginæ)*, *cham* (*Artocarpus Chaplasha*), *amari* (*Amoora spectabilis)* and *gurjan* (*Dipterocarpus turbinatus*). For the coming year, 1924-25, some 56 acres for new taungyas have been cut and burnt. There has been a certain amount of friction with the jhum cultivators over the question of leaving sufficient space at stake to prevent the plants from being suppressed by the paddy in their first year, but it is hoped to meet this by postponing the planting up of intermediate lines between the 30′ line till the 3rd year, when the jhum cultivators abandon their jhums, but will give occasional assistance in weeding. Except in one taungya the number of casualties amongst teak has been very small, and all blanks have been filled up with stump-pruned mixed evergreen species.

C. J. ROWBOTHAM, I.F.S.

ACROSS THE PEGU-YOMAS WITH A CONSERVATOR.

It was on a cold night in the beginning of December, when we got down at the station at 3 o'clock in the morning shivering

to the very bone and shouting "Cooly ! Cooly !!" Immediately afterwards we lade our carts and proceeded into the forests for 14 miles wishing good-bye to the railway line at least for a period of one and a half months. Our hearts were already heavy at the very thought of this so-called short tour, but think of the weight when a month later, when a revised tour programme showed an extension for another month and a half. At least there were with us two novices in the art of going into the forests, and they were a cook and a peon. They were afraid and so I and my co-clerk. Everyday we thought of Rangoon and the days to be spent before we got back, and many a time we abandoned the thought of ever returning alive or healthy.

Everyday we used to see the same set of people, the same herd of elephants and their attendants, the same kinds of trees and most of all, the same high hills and mountain rills ; and we were tired of them all. Off and on we saw a Karen *Te* here, and a *taungya* there, and at the sight of this miniature village our hearts wore a little smile ; not that we saw a new set of people here but that there was a chance of ransacking the poor Karen's field of some vegetables. That was a grand day for us all to have dainty dishes of sour jungle-brinjals and tomatoes. But the hill-loving Karen has a large heart and very often he gave us some roots and cucumbers of his frugal store in spite of our open plunder with permission, on his limited cultivation.

One day we saw a herd of 15 or 16 wild elephants grazing carelessly and joyously on the old open *ponzos*, and it was a silent pleasure to watch them ; and no one knows where all the pleasure had gone when a huge tusker brushed past the thick bamboo undergrowth to our left, trampling and trundling heavily to the farther side. I can never forget the way my co-clerk ran for his life and got up-hill and the fright with which my peon and our guide the Forester who carried a gun and only a few minutes ago, boasted that he was a good shot, made for their lives. That mighty beast ! Had he only known that we were also as much afraid of our lives as he was of his ! That very day, our conservator

sorely missed a fine type of *saing* which was lazily chewing the cud in the sun. Surely, the place was a very paradise for game.

It is usual here as in every other place for all elephant attendants to fall ill at one and the same time when they get wind of a long tour, and no sooner than a week had elapsed, they started giving us trouble which lasted all through the tour. Our elephant Jemadar is a queer fellow ; he who is not even a wee-bit afraid of our dangerous brute Mido, one day actually got through the back staircase of a bungalow to see his Sahib and get orders for the morrow, for the simple reason that the Divisional Officer had a dog with him. He fears a dog as much as we are of elephants. Men differ in their mettle and I cannot say anything but simply laugh in my sleeves.

So far so good and we began the New Year with a fine leg of venison for our dinner. That unfortunate victim, the barking-deer was shot by a mahout who never missed a shot for he was a one-eyed man.

And while we made our best to forget our remaining days in the forests by keeping as cheerful as we could in spite of our hard days, one day it happened that we should do a hot, dry, stiff march of 13 miles across paddy fields and stubbles, and I was much disappointed in not being able to have a glass to quench my thirst though there were Indian (Ooriya and Bengali) villages almost all along the village. Here I had a new experience. I found myself an untouchable and had to drink my water " pariah-fashion ; " and still at the cost of wet sleeves I did drink. That day alone I dreaded my way back over the same grounds once again, which was to be after a week or so. During those days we had no daily marches to make over dales and hills ; but our ten days ' turn away from the routine of jungle life, resulted in—thanks for a conservator who awaited us in the forests—affording us a vigorous physical exercise of 21 miles per day across the same old parched up paddy fields where not a sheltering brook could be seen though we were said to be touring in the forests.

And we had to pitch three camps before we could be said to have got clear of the Pegu-Yomas. The first day we did the

toughest part of the ascent and we went up and up and up resting at stages of about 20 feet and our first day's camp in the hills was exactly at a place where our legs refused to carry us any further. And those poor intelligent creatures, the elephants, too had the same trouble perhaps, but they were used to it. And they were all dark camps with swampy grounds and a little water.

Of course, after spending full two and a half months in the forests we got back to our dear headquarters only to spend with redoubled speed, what we had been unable to squander in the forests, and once again to give ourselves up to all the frivolities and luxuries in Rangoon. The trials of a tour clerk are great, and though at times enjoyable, are yet detestable. But let him always hope for the best.

R. K.

THE LIABILITY OF DEODAR TO THE ATTACK OF *TRAMETES PINI* (BROT. FR.) IN LOLAB, KASHMIR.

In his comprehensive monograph on *Trametes Pini*, Mr. Hole gives a list of 35 conifers, which are attacked by this fungus in Europe, America and Japan. This list covers practically all the pines, many *Abies*, *Picea*, *Larix*, *Tsuga*, *Pseudotsuga* and other coniferous genera, and the only exception appears to be *Cedrus*. Referring to the liability of deodar to the attack of this fungus, Mr. Hole wrote that, with the single exception of one tree and "notwithstanding careful search by local officers this fungus has never been found up to date on the deodar", but advised "that a careful watch should be maintained by the officers responsible for our coniferous forests for the appearance of this pest on other species."

And on this supposed immunity of deodar, Mr. Hole built up the theory that the best method of combating this disease was to replace the infected pines by deodar.

In view of Mr. Hole's remarks, the news that deodar also in Lolab (Kashmir), is liable to the attack of this fungus will cause no little unpleasant surprise. *The Lolab is, perhaps, the only place*

in India where deodar is liable to this disease, at any rate to this extent.

The Lolab is a lovely little side-valley in Kashmir, about 130 square miles in area. It contains extensive stands of pure deodar or deodar mixed with blue pine, and size for size, it possesses the richest forests in Kashmir, or for that matter anywhere in the Himalayas. The valley is known for its loveliness and in the words of Dr. Duke: "There are few more charming spots in Kashmir than the Lolab. If it lacks the wild grandeur of the Sindh Valley, or the majestic scenery of Gurez or the calm expanse of Dal or Manasbal lakes, it has a sylvan beauty nowhere excelled."

A Working Plan for forests in this valley has just been completed and such trees as were attacked by this fungus were enumerated, special care being taken to assign the infected areas to Periodic Block I. The total number of deodar trees above 1′ in diameter, which were found attacked by this fungus, is as much as 1,262. The following table gives the number of these trees arranged under the standard diameter classes used in Kulu :—

Table showing the number of deodar trees attacked by Trametes Pini in P. B. I., Lolab, Kashmir.

Diameter Classes.	12—17″	18—23″	24—26″	27—29″	30—32″	33—35″	36—38″	39″ and over
Number of diseased deodar trees.	86	232	217	203	229	157	67	71
Percentage which diseased trees bear to healthy trees.	0·2	0·7	1·08	1·1	1·7	1·4	1·3	1·4

A total of 1,262 diseased deodar trees is big enough, when it is considered that this number refers only to about 1/5th of the total area under deodar which is roughly 40 square miles. It is true all badly infected areas have been assigned to P. B. I., and there are not as many diseased trees in other Periodic Blocks, nevertheless the total number of deodar trees so attacked can be put at double that number or about 2,500. This estimate refers only to such trees as bear the bracket-like sporophores but in

considering the degree of infection it is safer to consider that trees without sporophores, but which are immediately adjacent to a tree which has a sporophore are already infected. This, on a conservative estimate, will increase the number of infected trees to about 10,000!

The severity of attack varies in different places in Lolab the areas which are very badly infected being Dorus-wain and Chandigam.

From the table given above, it will be seen that all sizes down to 3′ in girth are attacked. The youngest tree which bore sporophores was 1′ and 9″ in girth, and about 40 years in age., It is, therefore, evident that trees other than mature ones are also liable to this attack. The liability to damage, however, increases as the age of a tree increases. The falling off of percentage in higher diameter classes is due to the removal of mature trees under the previous fellings.

There is little doubt that the first species to be attacked is blue pine and not deodar. Enumeration in the *kail* forest showed that there were no less than 1,120 diseased *kail* trees in an area of about 15 square miles under the blue pine. In the past no effort whatsoever has been made to remove these trees, with the result that the affected *kail* have become centres of infection, and the disease is spreading rapidly all over the forest.

The effect of this fungus on deodar is a little different from that on *kail.* While in the latter case the core of a tree may be more or less completely rotten, in the case of deodar, the mycelia of the fungus search out and penetrate one ring only. This ring is the ring of weakness and during conversion logs or sleepers give way along this ring appearing very much like a cup shape. The attacked portion first becomes turmeric-yellow, but turns dark later on. In more acute cases of attack, several rings may be so attacked, or pockets of wood may be delignified and destroyed—the deodar becoming useless as timber.

The infection may spread either from root-grafts or by spores carried by wind or in both the ways. One other source of damage which is very often overlooked but which is at the root of this trouble in Lolab is the existence of certain holy shrines

(*ziarats*) at the edge of the forest. There are a number of such *ziarats* in Lolab, *e.g.*, at Dewar, Putshai, Dorus, etc. The trees growing in vicinity of these *ziarats* are considered to be too sacred to be touched and when these trees happen to be *kail* as they are at Dorus-wain and Chandigam, the result is that these trees on becoming old are liable to be attacked by *T. Pini*, and under the protection so offered by the holy enclosures, they become veritable centres of infection. In these cases, it is very difficult to do anything. The Forest Officer may be persuaded to remove these fungus-ridden trees, but he is helpless because no cooly would come and touch them. It cannot be definitely stated, whether in such places infection spreads more by root-grafts or by spores, but most probably both of these causes are equally operative. But there are instances in which an isolated diseased tree is found in the midst of apparently healthy trees, and the conclusion is irresistible that in the latter cases the wind is the more important factor. This conclusion would seem to be confirmed by the fact that the majority of sporophores occur towards the windward side. The number of sporophores borne by one tree may vary from one to four or five, or even more. The sporophores are generally found at the base of cut branches showing that the fungus gains access to the trees through wounds. The attacked trees are very liable to be upset by wind or snow.

The ravages of this fungus in the blue pine forests in Kulu have already attracted the attention of the Punjab Government but notwithstanding the fact that economic damage done by this fungus to deodar must be much more considerable than to *kail* the spread of this disease in the Lolab has received very little attention at the hands of the Kashmir Durbar. It is difficult to calculate the exact loss so caused to the State, but if the depreciation caused in the value of a diseased *kail* or deodar be taken on the average at 50 rupees only, the value of these (4,000) diseased trees is at least 2 lakhs of rupees. And if no special measures are taken to counteract the spread of this disease the economic loss to the State will continue to increase every year.

The old method of management (Selection System) offered little opportunity of combating this disease. On the other hand

ALSEODAPHNE OWDENI, PARKER.

Ganga Singh. del.

under this system every encouragement is given to these pests to spread from tree to tree, and it is impracticable to attempt to eradicate them owing to the enormous tracts to be worked over. It is now proposed to work these forests under concentrated regeneration system, and to cleanse each coupe as it comes under regeneration of these pests, and to keep the future crop more or less free of them by systematic cleanings and thinnings. But much will depend on the thoroughness of working and the angle of vision of the Durbar in regard to forest matters.

SHER SINGH, P.F.S.,
Kashmir State.

A NEW SPECIES OF *ALSEODAPHNE*.

ALSEODAPHNE OWDENI.—Parker, Arbor 18 m. alta; ramuli pallidi, glabri non crassi. Folia 8-12 cms. longa, 2·5—4 cms. lata lanceolata, in sicco fusco-nigra, apice basique attenuata, utrinque glabra, supra nitida, subtus pallida glauca, nervi laterales utrinque 4—7, arcuati, paulum prominentes; peteoli 5—10 mm. longi. Paniculæ e foliorum inferiorum axillis ortæ, folia superantes; pedunculi pedicellique graciles fere glabri. Perianthii lobi 2 mm. longi minute puberuli, ovati, in fructu caduci. Stamina filamentis puberulis, ordinis tertii filamentis glandulis 2 magnis juxta basim munita, ordinis quarti ad staminodia cordata reducta. Drupa 3·5 cms. longa, ellipsoidea, nigra, pedicello incrassato.

Cachar Hills, Assam circa 200 m. Nomen barbarum *Til Sundi*. J. S. Owden flowers and fruit; Upendra Nath 5,694 flowers May.

This species does not resemble the other species of *Alseodaphne* from Assam, having much smaller, thinner leaves and more slender shoots. The timber appears to be of good quality. We have seedlings of it in Dehra Dun raised from seed sent by Mr. Owden, but so far they have shown little promise of doing well. The plate accompanying the description (*vide* plate 16

has been drawn by Ganga Singh, Artist in the Herbarium of the Forest Research Institute.

R. N. PARKER,
I.F.S.

DEHRA DUN,
6th April, 1924.

THE EMPIRE FORESTRY ASSOCIATION.

The Empire Forestry Association held its Annual Meeting in London on the 26th February 1924, and the principal business done was passing a resolution allowing professional members of the Forestry Services of the Empire to become members of the Empire Forestry Association for an annual subscription of 10*s*. The resolution was worded as follows:—

> (iv) "Professional Members being such members of the Forestry Services of the Empire and such other professional foresters as the Governing Council shall in their discretion accept for membership under this classification, and who shall subscribe such sum as the Governing Council shall in each case determine not being less than 10*s*. (ten shillings) annually to the Association. Professional members shall have the full privileges of membership including the power to vote at General Meetings of the Association, access to the Association's premises and Library, the right to receive all publications issued by the Association, and the right to use after their names M. E. F. A. The Class of Honorary Correspondent and Foreign Members at present numbered (iv) shall in lieu thereof be numbered (v)".

Last year H. R. H. The Prince of Wales, as President of the British Empire Forestry Association, was in the Chair at the Annual Meeting at the Guildhall, and the "Times" account of the meeting, which was very successful, is attached.

In His Royal Highness's speech the objects of the Empire Forestry Association were described. It is hoped that as members of the largest Forest Service of the Empire, Indian Forest Officers will join the Association in large numbers.

The magazine of the Empire Forestry Association is a very interesting and valuable periodical, and will be sent regularly to all members.

It is understood that generally professional members will be admitted for the subscription named, *i.e.*, 10*s.* per annum Applications for membership should be sent to the Secretary Empire Forest Association, Imperial Institute, London, S. W. 7.

A. RODGER,
Member of Governing Council.

The following is taken from the *Times* of 3rd March 1923 :—

EMPIRE FORESTS.

THE PRINCE ON FUTURE NEEDS. CALL FOR STATE ACTION.

The Prince of Wales as President of the Empire Forestry Association, presided yesterday, 2nd March 1923, at the first annual general meeting of the Association in the Guildhall, where he was received by the Lord Mayor. The large gathering which filled the Council Chamber included the Duke of Devonshire (Secretary for the Colonies) and representatives of the Dominions and Crown Colonies.

The Prince of Wales, in moving the adoption of the accounts and the report, said :—Though I cannot in any way claim sufficient technical knowledge of forestry to justify my being in the chair to-day, it is a subject which has always aroused my keenest interest, and I have had in the last three years unrivalled opportunities of realising the vast timber resources of our Empire. I have had the good fortune of visiting lumber-mills in Canada and Australia. The Empire Forestry Association deserves, and I trust will receive, support from all those throughout the Empire who recognise the vital importance of forestry to the life of the nation, and the need for looking ahead and promoting systematic planting and conservation of existing forests if we are not to lose

one of the most important resources of civilization (cheers). Without a cheap supply of timber any progressive community must face disaster, having regard to the many needs we have for timber in every-day life, for which a regular and cheap supply is essential. This, however, can only be secured by close attention to forestry in all its aspects.

LOOKING AHEAD.

If we are to accept the evidence of those who have made a study of the rate of consumption of timber, the world, within the next twenty years, will be faced with a timber shortage, if not actual famine. No time must be lost in making provision for future supplies. Steps must be taken to replant the vast forest areas devastated during the war, estimated in Great Britain alone at one million acres, of which probably not 5 per cent. have been replanted. In addition to the one million acres cleared during the war, it is estimated that in Great Britain there are three million acres suitable for afforestation and for no other purpose, and the time is opportune, particularly in view of the urgency of finding solutions for the problem of unemployment. (Cheers.)

The Empire Forestry Association, as a great voluntary organisation, can do effective work by bringing home, not only to the people of this country but to other countries of the Empire, the need for action by the State, and also by private enterprise, which, if judiciously encouraged, can do so much in this matter. This is one of the several directions in which, by propaganda the Empire Forestry Association should be able to render a most important Imperial service, and I trust that the doctrine will be preached, not merely in London but by speakers throughout the provinces, and especially in those country districts in which the need for action is apparent.

This country, however, can never expect to be able to grow all the timber it consumes, and certain woods must be got from warmer countries. Considering how almost every kind of climate can be found within our Empire, it is unsatisfactory to learn that by far the greater part of the timber used by us is brought from abroad. This state of affairs suggests an alluring programme of

operations for the Empire Forestry Association to carry out, with the hope of remedying, even to a small extent, this deficiency in the forest production and economy of the Empire. The need for systematic forestry must be more fully realised and the doctrine of self-regeneration of forests no longer relied on as the sole mean of propagation.

An Imperial Forestry Bureau.

Another aspect of the many-sided work of the Association is to promote the use of the lesser known timbers of the Empire, including those of tropical countries, many of which are scarcely known in commerce. In this connection the Association should find it an advantage to have made its headquarters at the Imperial Institute, with access to the varied collections of tropical timbers which are shown there, and to have established co-operation with the Timbers Committee of the Institute in bringing about a better knowledge of the timbers of our overseas countries and their commercial usage. The interests, too, of timber growers in Great Britain must not be overlooked, and every effort must be made to popularise the use of home-grown timbers, whose valuable properties have only to be known to be better appreciated. (Cheers.) From the Empire point of view, it is hoped that the Association will play an important part in organising the forestry section at the British Empire Exhibition of 1924 by establishing an Imperial Forestry Inquiry Bureau which will act as a clearing-house for information and be a key to every exhibit incidental to forestry at Wembley. I sincerely trust that this Association will gain the support throughout the Empire that it deserves, and that to become a member and supporter of the Empire Forestry Association and its sister Associations in the Dominions will be recognised as the duty of all those who realise the high importance of the varied work which the Association desires to carry out. (Cheers.)

Timber for Housing.

Lord Lovat, seconding the motion, said that no Government faced with the tremendous problem of housing could forget the

importance of builders having a plentiful supply of well-grown and seasoned timber.

The motion was adopted.

Lord Lovat said it was right that those who had control of State planting should be open to criticism and should not spoil the beauty of our beautiful land. A body such as the Association ought to be, commanding respect, might be of real value in advising what they ought and ought not to do. It was not their wish to defile and destroy the beautiful places of the country but when they heard figures such as those given by the Prince as to the damage done during the war they must be up and doing to get the situation right. In this Empire there were 1,000 million acres of wood. In some years we had imported up to 120 million pounds worth of wood, and of this barely 20 per cent. came from the Empire. At the Trade Conference with the Dominion surely such a subject as the production of timber would be seriously discussed.

Mr. Grainger (British Columbia) said the trouble from fires in Canada was now being checked.

The Duke of Devonshire, moving a vote of thanks to the Prince of Wales, said that in any part which he had in preparing the agenda for the Dominions Economic Conference he would not overlook the matter in which the Association was interested. Referring to the British Empire Exhibition, he said there had been periods of anxiety, which he hoped had now once for all been brought to a conclusion. A very heavy amount of hard work was necessary to make the Exhibition a success. But under the guidance of the Prince of Wales, and with the cordial and generous good will of all classes, he was confident that the Exhibition could be a success.

The Prince of Wales, in reply, said he fully realised that the forestry of the Empire wanted organising. He had seen people burning wood in Australia simply because they could not get rid of it. Such a sight brought home to one the great work which the Assoc ation was doing and was going to do.

Among those present were :—

Lord Milner, Lord Buxton, Lord Clinton, Lord Plymouth, Lord St. John of Bletso, Lord Lamington, Lord Rothschild, Lord Aberdare, Lord Lyell, Lady Aylesford, Lord Dynever, Lords Leven and Melville, Sir T. Henderson, Sir W. Schlich, Sir E. H. Tennyson d' Eyncourt, Mr. J. F. Hope, Professor Fraser Story, Lieut.-Colonel D. W. Drummond, Mr. Gordon Selfridge, Dr. Simms, Sir Lawrence Wallace, Sir B. G. Elliott, Sir F. Duke, Sir B. Robertson, Sir Sidney Harmer and Mr. Morrison.

ANNUAL REPORT OF THE EMPIRE FORESTRY ASSOCIATION, 1923.

During the year 114 individual Members have joined the Association, whose total subscriptions amount to £205 5*s.* 0*d.*; fourteen Forestry Departments, Institutions and Trade Organisations have been elected Affiliated Members, subscribing a total of £152 19*s.* 0*d.*; receipts from Life Members and Donors amount to £150 and £10 10*s.* 0*d.* respectively. Three resignations and the death of three Members represent a loss in income amounting to £14. Membership now totals 356, being an increase of 142 during the year. Although membership increases but slowly, it is hoped that many new members may be enrolled at the forthcoming British Empire Exhibition at Wembley, where the Association will establish an Empire Timber Enquiry Bureau.

The most important event in the forestry world during the year was the holding of the British Empire Forestry Conference in Canada, at which an appreciative letter from H.R.H. The Prince of Wales, President of the Association, was read. The Conference was attended by the Chairman—Lieut.-Colonel G. L. Courthope, M.P.—as an official delegate, Lord Strafford and Mr. R. P. Dalley as associate delegates.

The last number of the Empire Forestry Journal contains a fairly full record of the proceedings at the Conference. Members will note with satisfaction the Resolution welcoming the incorporation of the Empire Forestry Association, and will be glad to hear that the Canadian Forestry Association have recently applied for Affiliated Membership, and are offering a subscription of

£50 an example which it is hoped will be followed by other Forestry Associations throughout the Empire.

Negotiations are proceeding with the Standing Committee on Empire Forestry which it is hoped will result in the Journal of the Association becoming the acknowledged medium for the publication of Official Reports and Statistics collected from time to time by the various Forest Services throughout the Empire.

The Council regret that, owing to lack of funds, it has been impossible to proceed with the establishment of a permanent exhibition of the commercial timbers of the Empire referred to in the last Annual Report. It is hoped, however, that this work may be resumed after the close of the Wembley Exhibition, when samples of various Empire timbers exhibited there will doubtless be available.

A site has been secured in the Forestry Section at Wembley and a suitable building is in course of construction which will become the Headquarters of the Association during the period of the Exhibition (April to October). A complete list is being prepared of every Timber Exhibit which will be on view at Wembley, and it is hoped to secure small hand samples of each for reference purpose.

The Council are not unmindful of the interests of the woodland owner in Great Britain and have been represented on the Committee dealing with the English Forestry Exhibit, where efforts will be made to popularise the use of home-grown timber and to create interest in afforestation generally.

Forestry has suffered a great loss during the present year owing to the death of Mr. M. C. Duchesne who, before being appointed to the Governing Council, was the first Honorary Secretary of the Association.

An alteration in the Rules is proposed relating to membership and rates of subscription, the Council being unanimously of opinion that steps should be taken to bring into membership every forest officer of whatever grade throughout the Empire.

It is gratifying to note the increasing demand for the Journal now edited by Mr. Fraser Story, to whom the thanks of the Association are due for the excellence of his work.

The Governing Council have placed on record their appreciation of the work undertaken by their Solicitor—Mr. Ernest Salaman—who has remitted his charges for professional work undertaken for the Association during the past year.

There will be certain vacancies on the Governing Council which will be announced at the Annual General Meeting. Members desirous of nominating representatives should complete the Nomination Form which should be handed to the Secretary before the commencement of the Meeting.

SILVICULTURAL NOTES FROM BIHAR AND ORISSA.

The following silvicultural Research work has been carried out in Bihar and Orissa during the last two months :—

(1) Two duplicate series of plots were laid out in Angul Division to test the comparative results of the method of working *Dendrocalamus strictus* forests proposed for that division and of that prescribed for Sambalpur Division.

In each series one plot is being left unworked as a control plot ; a second plot is being worked under a 3-year rotation, all culms being removed except 8 which may be of any age,—the proposed Angul system ; while in the third plot, which is also being worked under a 3-year rotation, all culms are being removed except all those under 18 months age and 6 culms over 18 months age—the Sambalpur system. In all plots the number of new culms produced will be enumerated annually.

(2) Two plots were laid out in the dampest types of *sal* forest in Angul division to test whether fire-protection is beneficial or harmful to the establishment of *sal* regeneration. A complete enumeration of all species present was made, both in the overwood and underwood, and similar enumerations will be made at intervals of 5 years.

(3) Two plots were laid out in drier types of *sal* forest in Angul division to test whether firing the area annually will prove harmful to the establishment of *sal* regeneration. Enumerations of the crop will be made quinquennially.

(4) Two plots were laid out in Angul division with the object of seeing whether in mixed forest containing a dense underwood of bamboos (*Dendrocalamus strictus* and *Bambusa arundinacea*), it will be possible to kill out the bamboos and obtain natural regeneration of the principal species in the overwood within a reasonable time by cutting the culms and burning them for one or two successive years.

It is interesting to note that on an area of similar forest which was treated in this way two years ago with the object of planting it up with teak there is now a splendid crop of fully established seedlings of *Adina cordifolia*.

(5) Six experimental plots have been laid out in the *sal* forests of Puri Division, where past fire-protection has resulted in natural regeneration of *sal* being killed out by invading evergreen species, with the object of seeing whether by annually burning over the forest natural regeneration of *sal* can be reobtained within a reasonable period of time.

Two of the plots consisted of strips one chain in width in forest with *sal* predominating in the overwood, on one of the strips the whole forest was clearfelled, while on the other strip all species except *sal* were felled.

Two plots consisted of groups 2 chains square situated in similar forest and treated respectively in the same way as the strips.

Two further plots, one a strip and the other a group, were laid out in forest containing hardly any *sal* in the overwood. On both these plots all trees except *sal* were felled.

In the case of all the above 6 plots any existing natural regeneration of *sal* was uprooted, while the material felled will be burnt in May. On two of the plots the number of *sal* seedlings appearing in the first year will be enumerated month by month while in all the plots the number of established seedlings will be enumerated once a year just before the plots are fired over.

(6) One plot was laid out in *Strychnos Nux-Vomica* forest in Puri Division to test the effect of pruning, pollarding and coppicing this species on the production of seed. The plot was divided

into 4 sub-plots. In one sub-plot the trees were coppiced; in another one they were pollarded; in the third sub-plot they were lightly pruned; while the fourth sub-plot was left untreated as a control plot. The weight of dry seed produced by each tree in each sub-plot will be annually recorded.

(7) One plot was also laid out in *Strychnos Nux-Vomica* forest to test the effect of coppicing dying trees on the production of fruit. The plot was divided into 2 sub-plots in one of which all dying trees were coppiced, while the other plot was left untreated. The height, diameter and condition of each dying tree in each sub-plot was recorded. The weight of dry seed produced by each tree will be annually recorded.

(8) One plot was laid out in the Puri *Casuarina* plantation to test the possibility of obtaining regular regeneration by coppice or pollard shoots. The plot was divided into 4 sub-plots in one of which the trees were coppiced flush with the ground, while in other 3 sub-plots the trees were pollarded at heights of 1, 2 and 3 feet respectively. The diameter, height and condition of each tree felled was recorded.

(9) Three plots were laid out respectively in 3, 4 and 5 year old *Casuarina* crops to test the effect of pruning on diameter and height growth. Each plot was divided into 2 sub-plots in one of which the trees were pruned of their lower branches up to about one-third of their total height, while the other was left unpruned as a control plot. The diameter, height and condition of each tree was recorded in each sub-plot.

(10) Four plots have been laid out in *Casuarina* crops planted last rains 4′ × 4′, 6′ × 6′, 8′ × 8′, and 10′ × 10′ respectively with the object of ascertaining the optimum planting-distance for *Casuarina* plantations. Careful records will be maintained of the cost and volume production of each plot, and of any sub-plots which may be subsequently formed and subjected to different methods of thinning.

(11) Sixteen plots have been laid out in the Puri *Casuarina* plantation to ascertain the effects of early thinnings of different degrees at different ages. The plots are being mechanically thinned

($\frac{1}{2}$, $\frac{1}{3}$ or $\frac{1}{4}$ of the crop being removed) according to the following scheme, duplicate plots being laid out for each particular method of thinning.

Series.

A $\frac{1}{2}$ thinning at 6 years followed by $\frac{1}{2}$ thinning at 13 years.

B $\frac{1}{4}$ „ „ „ „ „ „ $\frac{1}{3}$ „ „ 13 „

C $\frac{1}{4}$ „ „ „ „ „ „ $\frac{1}{3}$ „ „ 10 „

followed by $\frac{1}{2}$ thinning at 15 years.

D $\frac{1}{2}$ thinning at 8 years followed by $\frac{1}{2}$ thinning at 14 years.

E $\frac{1}{4}$ „ „ „ „ „ „ $\frac{1}{3}$ „ „ 14 „

F $\frac{1}{4}$ „ „ „ „ „ „ $\frac{1}{3}$ „ „ 12 „

followed by $\frac{1}{2}$ thinning at 16 years.

G $\frac{1}{2}$ thinning at 10 years followed by $\frac{1}{2}$ thinning at 15 years.

H $\frac{1}{4}$ „ „ „ „ „ „ $\frac{1}{3}$ „ „ 16 „

In each plot the volume of each individual tree thinned out was carefully measured. The total volume production of each plot will be compared at the age of 20 years.

In addition to the above experimental research work 12 *Casuarina*, 5 *sal*, 3 *Anogeissus latifolia* and 1 teak Sample-plots have been laid out in the Circle.

J. W. NICHOLSON, I.F.S.
Provincial Research Officer, Bihar and Orissa.

18th April 1924.

OBITUARY.

RAI LALIT MOHAN SEN BAHADUR.

We regret to announce the death of Rai Lalit Mohan Sen Bahadur, Deputy Conservator of Forests, and Divisional Forest Officer of the Sundarbans Division, who died on 18th March 1924, after a short illness, of fever combined with diabetes.

Mr. Sen, who was a native of Dacca District, joined the Bengal Forest Department in 1894 as a Forester, and was soon after deputed to the Forest School at Dehra Dun from which he passed out in 1897, when he was promoted to the grade of Forest Ranger. He received rapid promotion, being appointed to officiate as Extra Assistant Conservator of Forests in 1900 and confirmed in that grade in 1909. He was the first and senior of the officers promoted from the Provincial Forest Service to the Imperial Service.

In the early part of his career he was employed principally in the Jalpaiguri Division, but also in Palamau, Chittagong and Singhbhum, officiating as Divisional Forest Officer of Palamau in 1902. In the last 15 years he was continuously in the Sundarbans Division with the exception of the two years when he was Divisional Forest Officer, Kalimpong. He was Divisional Forest Officer of the Sundarbans from 5th March 1919 to the time of his death, and will be chiefly remembered for his connection with that Division where his administration was marked by independence of character, as also by the strict control and supervision of the administration and of the collection of revenue on behalf of Government. In the Kalimpong Division he successfully initiated the system of plantations combined with field cultivation. The "ring-fence" for the control of extraction and the collection of revenue as developed in the Bengal Sundar bans has been adopted in the *sundri* forests of the Irrawadi.

A useful officer and servant of the Government, of long service, has passed away.

REVIEWS.

TOPOGRAPHICAL MAP-MAKING.

AN ABSTRACT OF "THE MAKING OF A TOPOGRAPHIC MAP," BY J. K. PEARCE IN "THE MADRAS FOREST COLLEGE MAGAZINE," VIII, 3RD MARCH 1924.

The Method is described as the "Topographical trailer tape-Improved Abney Level" system, and is especially applicable to the mapping of an area with a view to preparing economical "logging" operations.

The mapping set consists of :—

(1) An unusually large and convenient form of Abney Level —the arc of which is graduated to give direct readings of the difference in height in feet for horizontal distances of 1 chain.

(2) A steel tape 2 chains long, with a trailer of about ½ a chain : the reverse side of the 2nd chain and the trailer are graduated to correspond with the graduations on the Abney arc.

(3) A special compass—with a needle instead of a dial,—folding sights,—and a movable arc on which declination can be set off—so as to give true bearings : the whole is mounted, through a ball and socket, on a sharp-pointed stick which may be stuck in the ground. The instrument is said to facilitate the running of straight lines through jungle.

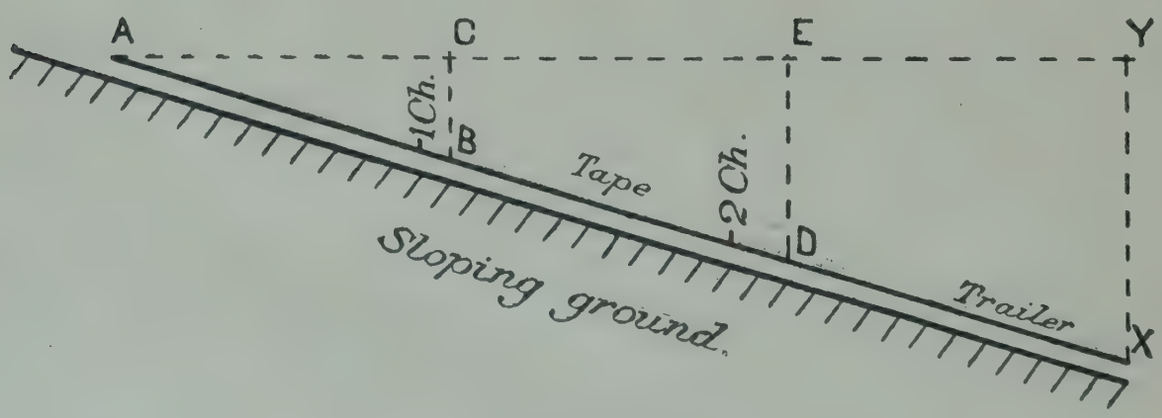

Figure illustrating the use of the trailer tape.
AX = Tape and trailer, = Horizontal.

The Abney reading gives the height in feet per horizontal chain, *i.e.*, CB, the point B on the reverse of the tape will be marked with this height. Therefore, if the gradient in feet per chain be known from the Abney, and the tape be grasped at the corresponding mark, the length AB on the slope will be equivalent to a horizontal distance of 1 chain. By doubling the Abney reading ED will be obtained and a 2 chain horizontal distance measured. In this way correct horizontal distances may be measured on a slope without any computation.

The map is made in strips—run either across or between base lines—the strips crossing the contours and the base lines running along valleys or ridges or other suitable places.

Base lines.—These can be surveyed accurately with a transit and a level, or less accurately with the mapping set—2 Abneys being used, one by the leader and one by the follower who check one another at each "shot." Base lines need not be straight, but as long sights as possible should be taken. They are then plotted to a suitable scale, *e.g.*, 200′—300′ or 400′ to the inch. The strips are then plotted, their width varying from six chains to two in open or closed jungle according to the surveyors range of vision. Points to mark the strips are inserted on the map, scaled off and pegged out in the field.

If a level is used, levelling should be deferred till the strip stakes are placed—the level of each stake being marked with a small peg on which the level is taken: if trigonometrical levels be used the levels of the stakes are set off from the nearest point with an Abney. The base map is then pricked off on to another sheet, which is cut up into strips for work—strip by strip—in the field.

Field work.—The surveyor and the compassman set out, the former with his sketching materials and his strip mounted on a board, the latter with compass and trailer tape. The compass is set on the proper bearing—ascertained from the base map—of the corresponding stake on the second base line—a tree or other prominent mark which lies on that line of sight is noted—as far ahead as possible. The Surveyor now stands with his feet evel with the strip stake level peg and sends the compassman

plus compass and the fore end of the tape ahead for one or two chains—he sights the Abney on a spot on the compassman previously found to be at the same height as the Surveyor's eye—grasps the tape at the graduation as given by the Abney and moves the compassman till the tape is taut: the latter will now be standing exactly one or two chains horizontal distance from the stake. A final reading is taken with the Abney and the point with its elevation marked on the strip map. (*N.B.*—If a one chain "shot" is taken the Abney gives directly the height above or below—if a two chain "shot"—the reading must be multiplied by two).

From the new point—facing the stake, the Surveyor orients his map and sketches in the contours and features on either side of the centre line of the strip according to a predetermined contour interval in hilly districts, 10′ in flatter is recommended).

The compassman meanwhile goes ahead another one or two chains and the operation is repeated, the Surveyor standing on the new point facing the old. When the compassman reaches his first sighting point he fixes another and so on.

Short "shots" are advised instead of clearing undergrowth and a mirror fixed to compassman's head at Surveyor's eye height is said to be useful for flashing position in dense jungle. Coolies with bill-hooks are useful. On reaching the 2nd base line—the error in closing on to the corresponding stake should be noted. The maximum error in elevation permitted in a mile run is ½ a contour interval—it is usually much less: bigger errors must not be passed.

Using a single base line—when the end of the strip is reached the compassman "right turns," goes the width of a strip, "right turns" again, and returns to the base line parallel to his 1st line.

Finished strip maps are then pasted on the base map and errors in line and distance corrected by shifting the strips and cutting them into sections, which may be shortened or lengthened by the insertion of small pieces as required. No change in the field sketches should be made. A tracing is then made on which any corrections, *e.g.*, the joining of contours that don't meet—are

made. Streams and large contour intervals (100) should be joined first, artificial features last.

G. F. W.

FOREST ADMINISTRATION IN THE PUNJAB.

A Review of the Progress Report of Forest Administration in the Punjab for the year 1922-23.

The outstanding feature of the year's report is the deficit of Rs. 14,09,198 on the year's working. After reading through the figures given in Chapter V, we are still not very clear how the loss has actually been incurred. The statement in para. 74, which admits only of a loss of Rs. 1,73,000 fails to satisfy us, that this is the correct figure, since in calculating it expenditure classed as capital expenditure is excluded, whereas items of revenue (which, as explained in para. 72, cannot be considered normal forest revenue) are included. The real amount of the loss is therefore not apparent. The first figure given is certainly too high and the second too low. Appendix V gives the results by divisions and shows that the losses almost all occurred in the hill divisions. Paras. 114 and 115 show that only deodar timber is now being sold at a profit from these divisions, *chil* and fir fetching in the open market only about half the cost of extraction. As the value of timber has fallen to one-third what it was two years ago, it is not surprising that all estimates of profits have been completely falsified. As timber works in the hills take time to start, and once started cannot be closed down suddenly, it is difficult to obtain the full benefit of a rise in the market by increased production, or to avoid the consequences of a fall in prices by curtailing the output. Government can hardly expect to be immune from losses, which have been incurred by timber traders generally, and have caused the failure of several large undertakings in other parts of India.

The report opens with the usual statement of the area of the forests, which now amounts to 6,238 sq. miles. A diagram given in the appendices shows the area of the province to be

100,223 sq. miles. From these figures the Local Government in its review remarks that the Punjab has only 7 per cent. of its area under forest. Without wishing to cavil at the arithmetic of this calculation, it is certainly an over-estimate of the position. Appendix I classifies the forests into " Lands under tree growth " and " Waste lands." Taking the former figure we find that 2·3% of the Punjab is forest in the popularly understood meaning of the word.

Irrigated plantations, although the mainstay of the year's revenue, suffered badly. Kot Lakhpat plantation has been abandoned altogether. In para. 35 we read, " In Changa Manga the supply of water from the canals was again deficient, large numbers of mulberry and *shisham* died and large areas will have to be completely restocked." In spite of the water-supply being very short for the existing plantation, the area was increased by 255 acres of fresh sowings. The plantation is evidently growing like a " fairy ring".

The chapter on research and experiments seems to record a good deal of misapplied effort. Numerous unlikely species have been tried already in irrigated plantations but nothing quite so unpromising as maritime pine! *Populus euphratica*, if it were more abundant and less defective, might be of value for three-ply wood, but *Populus ciliata* is quite out of the question. Blue pine is not likely to make a particularly good match, and is too valuable for other purposes to be worth consideration either for matches or paper pulp. We are told that mulberry is being tried for textile implements such as picking-arms. Actually it has been used for this purpose for at least ten years.

R. N. P.

THE MADRAS FOREST COLLEGE MAGAZINE.

This magazine, now in its eight volume, is run for the Ranger-Class (including Foresters), and is published quarterly at the low subscription of Rs. 2 per annum and an entrance donation of Rs. 2.

The March number contains articles on " Causes of Deforestation," by C. E. C. Fischer; " How to keep fit in the Forest

Department," by M. R. Ry. G. N. Subba Rau; "My favourite tree," by M. R. Ry. Kullappan Pillai; "Botanical Curiosities," by the Editor; "A prismatic compass Survey," by M. R. Ry. C. M. Kushalappa; "The making of a Topographic Map," by J. Kenneth Pearce, etc.

EXTRACTS.

THE EFFECT OF FIRE ON REGENERATION.

The Forest of Sangseri is situated at 5,700 feet above sea level in the Western Himalayas, and comes under the jurisdiction of Rawalpindi East Forest Division, Punjab. It consists of a pure forest of *chir* pine (*Pinus longifolia*). During 1917-18-19 regeneration fellings were done, and about seven trees per acre were left as seed-bearers. In June 1921 a fair amount of regeneration was to be seen, but at this time the forest was maliciously burned. The fire did enormous damage, destroying the new growth of seedlings, charring the soil to a depth of six inches in places, and even disintegrating the rocks of sandstone. In order to fill up the blanks to complete the new crop, artificial regeneration was resorted to.

In early July 1921 *chir* seed was sown in patches of three feet by three feet, the patches being five feet apart. Where the ground was very steep and there was the danger of the seed being washed away, dibbling was done. The ground was hoed to a depth of eight inches and the soil properly loosened. The charcoal ashes were mixed with the soil wherever practicable. In the end of July 1921 most of the seed had germinated, the best examples being where the sowing had been done in patches. Natural regeneration was also coming up well, as some of the seed-bearers had not been badly damaged. In the burnt areas the seedlings were taller and more healthy than in the unburnt areas.

In August 1922 the area was inspected and the following points noted:—(1) In the burnt area, growing in ashes, many seedlings were up to one foot one inch in height. (2) In the burnt

area, but not growing in ashes, seedlings were up to eleven inches in height. (3) In unburnt areas the seedlings were up to nine inches in height. When inspected in September 1923, many young plants in the burnt area, growing in ashes, were discovered to be over three feet in height, the best of all being three feet four inches, and showing very healthy growth all round. These plants are now in their third year, as they were sown in July 1921. The young plants in the unburnt area are eighteen inches and less in height, and do not show such healthy growth. In June 1921 the fire was described as very harmful, but the example proves that fire can be employed with great benefit in areas under regeneration.—[*H. S. D.* in *Sylva*, *No.* 4, 1923.]

A REVIEW OF INDIAN FOREST MANAGEMENT.

After some years spent by the Indian Forest Department in the organisation of the forest estates made over to its management, the necessity for the introduction of some sort of silviculture and forest management began to make itself apparent. Sir Dietrich Brandis, who was appointed to the charge of the Pegu Forests in 1856, laid down the first system of management. Having to deal with large areas, often imperfectly explored, in which perhaps only one species in a mixed crop was marketable, he had no option but to employ a rudimentary selection system based on an arbitrary girth limit and to regulate the yield by numbers of trees of this exploitable girth. This system came to be universally applied in dealing with high forest, and it is only within the last 10 years that efforts have been made to introduce something better and more in accordance with the highest ideals of silviculture. It is not proposed to enter into a discussion as to the merits and demerits of the recognised silvicultural system, this has been adequately dealt with in the *Indian Forester* *; indeed, India is at length developing a silviculture of her own, influenced but not necessarily bound by the theory of European forestry. Silviculture is not an exact science, yet its principles

* *Indian Forester* December 1921 —Forest Management—C. G. Trevor.

are of world-wide application and guided by these fundamental rules every country must work out its own salvation.

The great failing in Brandis's management was that the age classes, or what girth or diameter classes were taken as corresponding to the age classes, were never distributed on the ground in accordance with the ideal selection forest, so that while in theory tables of the different age classes might appear to be normal, in practice it often became impossible to take out the calculated yield by any fellings which could deserve the name of silvicultural fellings. Alternately in certain compartments containing a large proportion of the older age classes and copious advance growth, the limitation of the number of trees to be removed was often prejudicial to the best silviculture, more especially as the felling of sound immature trees was almost always prohibited. In order to get over the latter difficulty prescriptions in working plans were often flouted, to the benefit of silviculture to be sure, but with disastrous consequences when revision of the plan became necessary. The gravest objection of all was that in the too many cases natural regeneration was not obtained, and there being no obligation to regenerate certain areas, this, the *sine qua non* of management, was left entirely to chance.

In division after division after being in operation for 30 years or more the system became unworkable, and steps were taken to introduce silvicultural systems in which the regeneration of a normal area and a normal distribution of the age classes became of paramount importance. Now no enlightened management can exist without a knowledge of the silviculture of the trees being dealt with, and this knowledge is being built up year by year both by research officers and the ordinary members of the executive staff, many of whom are conspicuous for the good work they have done. The silviculture of many of the important species has been worked out to a satisfactory conclusion, and a great impetus has consequently been given to this branch of learning; but of course much remains to be discovered, and even where regeneration, whether natural or artificial, has been reduced to a routine new refinements in technique are constantly being elaborated.

It will be of interest to foresters in various parts of the Empire to read a short account of silvicultural systems actually being practised over considerable areas. A full account of the systems used in Northern India, together with methods of calculating and regulating the yield has already been written and the book is now in the press.* It would be out of place in this short article to attempt to cover the ground dealt with in this publication, so that all that will be attempted in this article is to describe in a general way the chief methods used in the management of the high forest of the principal species.

I. Conifers.

The conifers of importance are the deodar (*Cedrus Deodara*), the pines (*Pinus excelsa* and *longifolia*), the spruce (*Picea Morinda*), and the silver fir (*Abies Pindrow*). *P. longifolia* has for many years been managed in Kumaun under the shelterwood compartment system; this management has now been extended to the Punjab forests. Regeneration is comparatively easy with six to eight good seed-bearers to the acre, if only fire protection can be obtained. Owing to the incendiary fires of 1921 the working plans branch in the United Provinces have been considering whether it may not be necessary in the future to take a step backward and to adopt the modified system employed by the French in the pine forests of Corsica. This would be a retrograde step and would result in inferior financial results, and certainly inferior silvicultural technique, and it is sincerely to be hoped that the good sense of the people will not render this necessary. The chief faults in the past have been slowness in completing regeneration and not sufficiently drastic felling. It is now admitted that in regeneration fellings the correct number of mother trees should be selected and everything else cut.

The blue pine (*P. excelsa*) in the Punjab is regenerated in a similar way, only more seed-bearers are retained, and an admixture of deodar is generally attempted either by reserving this

* "A Handbook of Forest Management for the United Provinces," Trevor and Smythies, Supdt., Government Press, Lucknow, a review of which will appear in our August number, Hon. Ed.

species among the mother trees or by artificial sowing and planting.

The deodar is by far the most valuable of the conifers, and forests containing this tree have been under management for nearly 50 years. Brandis's selection system was in use up to ten years ago, with various results, depending to a great extent on the incidence of the grazing. Every sort of felling has been made under this system, as beyond regulating the number of trees to be cut everything else was left to the discretion of the man who marked the felling. Good regeneration is found in many places, but it is more often due to chance than to well thought out management.

The system now in force is the shelterwood compartment system, leaving the mother trees 30—50 feet apart. Compartments felled over in this way, cleared of lop and top and felling slash, and closed to grazing, have generally regenerated very well. Areas have been regenerated in one year by long-sighted management and taking full advantage of a seed year. It is considered essential to complete regeneration as quickly as possible, even with artificial help, rather than to prolong the process and get the regeneration area full of weeds.

This system has lately been extended to the management of the spruce and silver fir forests of the Himalayas, which very much resemble the forests of the interior wet belt of British Columbia, but complete success has not yet been obtained.

The most difficult of the Himalayan forests are still managed under a selection system, but a much improved system under which the yield is regulated by volume. The exploitable size has been abolished, and everything felled down to the diameter class enumerated counts against the prescribed yield.

II. Sal.

The sal (*Shorea robusta*) is the most important broad-leaved timber tree of the Sub-Himalayan foothills and flats. In new working plans the tendency is to regenerate under a shelterwood, partly by coppice and partly by seed, or in localities not subject to frost to obtain a more or less suppressed advance growth before

the main fellings, and then to clear cut and regenerate by coppice, completing the crop artificially by sowing sal with or without field crops, or by filling with supplementary species. Much more remains to be discovered about the silvicultural peculiarities of the sal seedling. The North Kheri Division of Oudh is still under a transitional selection system, and here selection has been elaborated so far as to provide a graph of the age classes of the actual growing stock in every compartment with the normal selection forests; not to bind the marking officer, but in order to show him exactly how he is situated as regards his age classes.

In Bengal and Assam, clear felling and artificial regeneration with field crops is looked upon as the solution of the problem; but in the remoter valleys it is doubtful if sufficient labour can be obtained. Where labour is available and fencing against wild animals has been possible, very excellent results have followed.

III. Teak.

The easiest method of regenerating teak (*Tectona grandis*) is by clear felling, followed by artificial regeneration with field crops. The cultivators undertake for a moderate payment per 100 plants to weed the young teak along with their crops. The teak seeds are dibbled at stakes 6ft. × 6ft., and very young plants are used as fillers where necessary. The latest development is to broadcast miscellaneous species between the teak, so that the ground may be covered quicker and the costs of weeding after the first year reduced. The extent of the work being done in Burma may be judged by the fact that for the year ending 31st March 1921, 84,723 acres of these plantations existed in this province. Burma and Bengal have almost perfected this work, and any forester who may think of experimenting along these lines should certainly obtain all the literature on the subject from the Forest Research Institute, Dehra Dun. As regards the natural regeneration of teak, this has been obtained from seed stored in the ground after clear felling and burning. It appears that the young teak will not stand shade or drip, and must have complete overhead light. Regeneration has also been got by elaborate and repeated clearings, but most

authorities prefer the simpler and less costly system of regenerating with field crops.

The Calculation of the Yield.

Where the periodic block system is in force no complete allotment of compartments to periods is attempted. Sometimes only periodic block I. or the regenation area is laid down ; in other cases both period block I. and the last period, containing areas recently regenerated, are definitely allotted. In the case of sal it sometimes becomes necessary to consider which compartments should come under regeneration in period II., so that these may receive special treatment. Now that yield tables are becoming availabe, the use of reduced areas to compensate for quality are being more employed, and volume tables by quality classes render the calculation of the yield and the estimation of the outturn more accurate and reliable than was previouly possible. In such plans the calculation of the yield from main or regeneration fellings is by volume :

$$\text{Yield} = \frac{V + (i) \times \frac{P}{2}}{P}$$

Where V = Volume standing in the regeneration area.
i = current annual increment of above.
P = period.

The intermediate yields in other periods are by area.

When it is necessary to calculate the yield by volume for the whole working circle, to include both final and intermediate yield Heyer's or Von Mantel's methods are used, and an attempt is made to allot the proportions of the yield to come from final and intermediate fellings. These methods are also employed in the case of selection forests. A modification of these methods has to be made to compensate for the difference in age between the youngest diameter class included in the enumeration list and the total rotation. These modifications are mathematically explained in the handbook referred to.

Regulation of the yield by area is employed for all clear felling systems ; in shelterwood fellings regulation by volume is generally

preferred, but this is not universally so. The days of one stereotyped silvicultural system and method of calculating the yield have passed, never, it is hoped, to return. We aim at using that silvicultural system which will give the best results in the case of each individual working circle, with all due consideration to the silviculture of the tree we are dealing with in its special environment, and the fixed conditions of situation, climate and market requirements which differ not only from one division to another, but from one working circle to another. We employ these methods of calculating and regulating the yield which suit our purpose best in each individual case. It is sometimes thought that such intensive forestry can only be practised on small areas. In many divisions of Northern India such systems are in operation on areas of 50,000 acres. In the much larger divisions of Burma very intensive work is carried on in the areas under regeneration, though these are often far short of the normal area which should be dealt with. Real silviculture encourages the zeal of the whole subordinate staff; once have a definite area under regeneration in which something is going on, in which the staff can see the plants growing, and half the battle is won. Many instances can be given in which the sight of a completely regenerated crop growing like a field of corn excited the greatest enthusiasm from the mere forest guard who had watched over it from the beginning. If only this atmosphere can be obtained, instead of the apathy so much complained of, men will work all day in pouring rain without a thought of complaint. Indian forestry as a whole has still a long way to go, but in these divisions in which scientific forestry has been developed by the unremitting toil of the officer-in-charge, the visitor may see the whole art of the adept displayed, and will carry away with him the impression that Indian forestry much of interest to other members of the profession, no matter has from which country he may come. [*C. G. Trevor, I.F.S.*, in *Empire Forestry Journal, II, 2nd December 1923*.]

CORRESPONDENCE.

FIELD CROPS IN TAUNGYAS.

SIR,—I have read with very great interest Mr. Mercer Adam's article in a recent number of the *Indian Forester* advocating enquiry into the value of crops other than paddy in *taungyas* as well as Mr. Unwin's "Forms and Reforms" rejoinder. I hold no brief for Mr. Mercer Adam, but even so he seems to have been dropped upon from so great a height, that I cannot restrain a sympathetic tear when I find his mangled corpse in your pages.

He seems to me to have demonstrated the entire uselessness of one annual form at least, as if every thing that could be found out was found out between 1865 and 1875, and duly recorded in annual reports, with the result that in 1923 an officer, in all good faith, and in a spirit of earnest enquiry, has never heard of it, then what is the good of the form in question? This, however, raises another query, and that is, whether Mr. Unwin is correct in using the experiments of 1875 to prove that the growing of other crops is useless at the present day. Personally I doubt it; no better instance could be afforded than that of Amery's Clear-Felling Working Plan for Gorakhpur, which was cancelled in great haste in 1875, and work was started at once to remedy the dreadful damage it did,—work which was carried on till 1887 when it was abandoned,—and in the words of the Conservator's report: "We must reconcile ourselves to having turned this area into a blank." A truly sad affair, as in 1913 that blank merely had 1,600 healthy stems to the acre, and the disgusted Working Plans Officer, instead of sending his son into father's old job had to make him First Lord of the Admiralty instead, rather a come-down. In 1914 the old prescriptions were repeated in a new plan almost word for word, and have resulted in one of the most successful plans ever written in India. So much for the proofs yielded by the experiments of 1875.

Knowing nothing of Burma, which is not visible, even on clear days, from India's Coral Strand, I do not of course, mean

that Mr. Unwin is not correct in saying that in this case it would be useless to repeat these experiments; but from a different angle of vision, or whatever you like to call it, Mr. Mercer Adam's article was most suggestive, and there are a number of localities with the conditions of which I am familiar where such an enquiry would be most useful, and, in case any one likes to take up such work, I herewith make suggestions; it would be very suitable for a man of the type of Hole when investigating the artificial regeneration of sal.

Taungya—so called—has now been going for 2 years in Gorakhpur with a view to regenerating *sal* coupes. Conditions, are entirely different from Burma, a railway line runs through the coupes, the surrounding population is very dense, and demand for land keen. The *sal* is—relative to the teak—a slow grower and weeding is necessary for 3 years. An essential is frequent working of the soil between the lines of *sal*. The subsoil being clay, it is desirable, and often essential, to ærate it as much as possible. The *sal* seedlings are intolerant of shade which greatly retards their development. The *sal* is not sown the first year when crops only are taken, but is sown the second year. Almost any crops can be grown, and 2 crops a year, *Kharif* and *Rabi*. Various investigations would be well worth while.

(1) Rice is the *kharif* crop. There are, here, 3 types of rice, the *Dhan*, the *Jarhan* and the *Boro*. The two latter are grown wet, and therefore have to be ruled out. We can therefore only grow the *Dhan* or dry rice, which is sown at the break of the rains and reaped at the end of September. The varieties of "*Dhan*" grown in the district is legion, and we want to know which is the best. The two we have done most with so far are the "*Sathi*" and the "*Sarya*," and the results from these two, such as they are, clearly show the scope there is for inquiry.

(*a*) *Sathi* Rice.—The land cannot be cleared till the rains break, it is too hard in the hot weather. Where the ordinary cultivator ploughs his field on the first rain and sows his rice, he can get in the crop a few days after the rains break. The *taungya* cultivator, however, has to clear, dig, extract the small stumps and

then plough. This takes a very long time and he is desperately anxious to get a crop the first rains. *Sathi* ripens in 60 days and can be sown 3 weeks later than the other varieties. It is a rice, the grain of which never emerges from the ear, and the cultivators say, probably with a certain amount of truth that animals in consequence, do not graze it. Its straw is short, and therefore throws much less shade, an advantage for us. The grain is of fair quality, but the yield is not so heavy as with some varieties. On the other hand cultivators say that it is less prone to attacks from the rice fly than other varieties. As this last year in this district the rice fly took some 4 annas of the crop and our rice escaped, there is probably some truth in this, and it is an advantage as we wish to keep our cultivators in a state of "pathetic contentment" so far as possible.

(*b*) *Sarya* rice prefers rather more clay in the soil. It is coarse, but a very heavy cropper both in grain and straw. One field we grew last year yielded 21·3 maunds unhusked paddy to the acre. The straw is, however, very long, and shades our seedlings too much.

There are about 60 more varieties, I understand, in the district. What I want is to find one of them which has short straw, in which the grain remains in the ear, and which ripens quickly like the *Sathi*, but which gives a yield of grain like the *Sarya*. As this work has been, presumably going on for 60 years or so, and as I have not access to the annual reports of those days, can Mr. Unwin tell me what I want to know? If he can he will be very welcome to "*Kalyani*" from all my threshing floors.

(2) As regards our *rabi* crops, we have so far tried wheat, barley, mustard, linseed, gram, chillies, monkey-nuts, sweet potatoes, ladies fingers and, alas, *arhar*. Sugarcane is prohibited. Of the others, all seem suitable from our point of view, the first year, but when the *sal* is sown *arhar* must be rigidly ruled out.

What we want the first year is to get a good tilth. Wheat is obviously the best for this, as it will not grow unless the tilth is of the best. It requires heavy watering however. Of the others linseed is good as the shade is light. Gram is a low crop and good for the same reason, it is likewise a *legume*.

The first year we want to ærate the subsoil. *Arhar* is a egume with a woody stem as thick as one's wrist very often on new land, and with very deep and branchy roots. It is also a legume and presumably nitrifies the soil. Its shade is so dense that it is useless once the *sal* is sown, but the mass of roots and rootlets in the first year, penetrating the subsoil in all directions and which rot in 3 months after harvest should riddle the subsoil with fine holes.

If the experiments of 1865 to 1875 are final and conclusive could any one tell me from them, now that the trees have grown up.

(*a*) The effect on subqseuent development on our seedling of cropping with *arhar* the first year to aerate and nitrify the subsoil.

(*b*) The best crops to grow after the first year from our point of view. Do some crops impoverish the soil more than others and affect subsequent development of seedlings; do legumes, with their nitrifying properties, improve subsequent developmeut as compared with other crops or not?

(*c*) Does continuous cropping for 4 years improverish the soil to an extent which will seriously affect the locality from the point of view of tree growth. I discard Swiss results, etc., as I do not believe they necessarily apply.

I may add that these questions are of very real importance over large areas in *sal* provinces. By doing various "wheezes" of this nature we have in the last few years managed to produce on large areas in the open forest complete crops of *sal* seedlings whose development has considerably exceeded that of Hole's ideal seedling development in a nursery, and this on soil where the old forest was below 3rd quality, and where different qualities of

soil have given markedly different rates of growth in seedlings from the date of germination.

I merely want to know these things, I don't care whether my information comes from Yomas or Yogis, Professors or Pundits, Dusty Daftars or D. F. O.'s., Can Mr. Unwin enlighten me?

B. R. WOOD, I.F.S.

THE KING'S BIRTHDAY HONOURS.

We offer our heartiest congratulations to the following recipients of the King's Birthday Honours:—

KNIGHTHOOD.

Mr. P. H. Clutterbuck, C.B.E., C.S.I., etc., Inspector General of Forests.

M.B.E.

Mr. G. C. Cheyne, Deputy Conservator of Forests, Burma.

RAI SAHIB.

Thakur Dhyan Singh, Forest Ranger, United Provinces

Fig. 1. The Power Pressing Mill with a pair of Ruston Presses.

POWER ABSORBED PER DAY. 30 Coolie units, 1 Fireman, 1, 3rd Class Engineer, and 8 B. H. P. from small portable steam engine, consuming $1\frac{1}{2}$ khandies of wood fuel per day.

OUTTURN PER DAY OF $8\frac{1}{2}$ hrs. 600 bales weighing about 100 lbs. each.

Fig. 2. A Hand Press adapted to working with Power.

POWER ABSORBED PER DAY. 5 Coolie units, and about 4 B.H.P. from a steam engine.

OUTTURN PER DAY OF $8\frac{1}{2}$ hrs. 45 bales ($4\frac{1}{2}' \times 2\frac{1}{2}' \times 2'$) weighing nearly 225 lbs. each.

Fig. 3. Temporary storage of grass for checking pending removal to the permanent storage sheds. One Karkun with a pair of coolies can weigh 600 to 800 bales in a day of 8 hrs.

Fig. 4. A line of storage sheds. The capacity of these sheds varies from 18 lacs to 20 lacs lb. in each shed.

Photos by T. K. Mirchandani.

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HOW BOMBAY INSURES AGAINST FODDER FAMINE.

The greater part of the Bombay Presidency, excluding Sind, depends for its food supply on the south-west monsoons, that happily invade this presidency from the beginning of June to the middle of October each year.

In years of defective or irregular monsoons, the Gujrat and the Deccan plateau (excluding the areas commanded by the Deccan Irrigation schemes), are the localities liable to that much dreaded occurrence the "Indian Famine." The shortage of food supply for human beings is almost always accompanied by shortage of the fodder supply for cattle and the other useful domesticated animals which are necessary for the agricultural and domestic economy of the ryots. The protection of the cattle and specially the milch and agricultural cattle is nearly as important as the protection of human lives in the affected areas.

The Famine Relief Department of the Government of Bombay have devised a general scheme for coping with the shortage of fodder wherever it may happen in the Presidency. The main principle of the scheme is to purchase every year fresh dry fodder grass, to the extent of several crores of pounds, pressed in suitable bales, and store it in godowns specially constructed for that purpose. The amount of grass purchased and stored each year varies from year to year according to the budget allotment, sanctioned for the purpose by the Legislative Council, for that year.

At present the purchasing depôts, with their pressing mills and storage sheds are distributed as follows:—

(1) Godhra
(2) Dohad
} in Northern Gujrat.

(3) Navapur
(4) Palghar
} in Southern Gujrat and Western Deccan.

The grass purchased in one year is stored up to 3 years and sold to the authorities distributing fodder in famine areas at any time that it is required ; or else after it has been stored for three years, it is sold in the general grass market when not required for famine purposes. Thus at any one time there is one to three years' store of grass in hand (excluding the current year's supply) to cope with an emergency like the wholesale failure of the monsoon over large tracts of the country.

This storage of grass for periods up to three years entails certain losses, *e.g.*, shortage in weight, destruction of grass by fungoidal or insect attacks, losses due to sales in the general grass-market, loss of interest on capital investment, etc.,—these charges being in the nature of an insurance fee against fodder-famine during the year.

The grass stored is pressed by steam power presses into bales of $3\frac{1}{2}' \times 17'' \times 23''$ = nearly 9 c.ft., weighing nearly 90 lb. each. The present price at which grass is pressed and stored is Rs. 12 per 1,000 lbs. free delivery in our storage godowns, and free delivery on rail in case of famine. The present selling price for Famine Relief is Rs. 16 per 1,000 lb. free on rail.

The contractors for this work are given facilities for cutting grass in Government lands. They have been allotted plots for the purpose in the Reserved Forests and the village *gurcharans*. Under agreement they are bound to bale a certain quantity of grass fixed for each of the above-mentioned supply stations. But it is optional for the Government to purchase any quantity *under* the above figure, after giving timely notice of the same to the contractors. Any grass in excess of Government requirements collected by the contractors from Government lands is allowed

royalty free to the contractors. Most of the storage sheds are wooden structures covered with galvanised corrugated iron sheeting. From last year the Forest Department has started constructing more permanent and economical masonry and steel structures. One such shed has been built at Dohad and one at Godhra. At present one all-steel storage shed is under construction at Palghar.

It has been worked out that the new sheds are more economical in cost of storage per lb. than the previous structures.

The whole of the administrative work of this part of Famine Relief is carried out personally by the Chief Conservator of Forests, Bombay Presidency, through the co-operation of his executive staff in the districts.

T. K. MIRCHANDANI.

THE INCREASING POPULARITY OF *BAKAIN* IN THE PUNJAB.

For many years the natural seedlings of *bakain (Melia Azedarach)*, which appeared in the irrigated plantation of Changa Manga, were ruthlessly cut out as a weed, but in spite of this treatment and the constant damage done to the coppice shoots by nilgai, it has apparently "come to stay." Although a short-lived species, its growth during the first 10—12 years is very much faster than either *shisham* or mulberry in Changa Manga, in fact, unless it occurs in groups of pure *bakain* it develops as a wolf-tree, becomes branchy and also grows many burrs bearing epicormic branches. It has replaced the mulberry in many places which were starved of water during the dry years of 1920-21, and is thus a more reliable species for irrigation work when the water supply is unreliable.

During the war years it was sold as logs and as firewood when it occurred in the fellings, and during the last year it was sold in the Changa Manga auctions at a steady price averaging Rs. 1-1-8 per cubic foot for small logs. Its chief uses in the Punjab so far appear to be for light furniture, packing-cases, and shelving, though as it becomes better known many other uses should be found for such a light strong wood. It is apparently

being taken up for planting in Australia as a suitable wood for packing-case work, and this is probably its best field of development. Its value as a firewood compares favourably with that of mulberry.

From a sylvicultural point of view it regenerates best under a light shade and develops later as a light demander. It is useful as a nurse-tree for more delicate species, and a group of four-year-old *bakain* has been found invaluable in the forest nursery in Daphar irrigated plantation in shielding seedlings of *Eucalyptus*, *tun*, and fruit trees from the scorching afternoon sun. In the canal colonies throughout the province one sees that the cultivators have appropriated this species as an easy means of growing shelter for themselves and their cattle, for there are many small clumps of two or four-year-old *bakain* growing apace around their huts.

R. M. G.

STRYCHNINE IN SANDAL.

During the course of my inspection of the enumeration of sandal trees in the northern part of Mysore, I came across a few sandal trees growing near trees of *Strychnos Nux-vomica*. As this was a host plant I had not met with before, I examined the root-connections, half-expecting that it might turn out to be a bad host, as it is closely allied to *Strychnos potatorum*, the roots of which I have found to be nearly immune to the attacks of the sandal haustoria. But the roots of *S. Nux-vomica* were extensively attacked and the woody cylinder penetrated in most cases, the haustorial cushions being medium to large in size. In addition, all parts of these sandal trees including the leaves, bark and wood, were intensely bitter to the taste, similar to that of the host-plant. This strychnine imbibed from the host-plant appeared to have no ill-effect on the sandal trees, as they were all vigorous and healthy. Specimens from these sandal trees have been sent to Dr. Coleman for investigating the percentage of strychnine present in different parts of the tree.

This case serves to question the existing theory that sandal takes only the crude sap from the host-plants. In the case of sandal and *S. Nux-vomica*, it is certain that the sandal has absorbed some organic substances from the host in addition to the crude sap. This may be explained in two ways, (1) that the sandal haustorium may also function in the absorbtion of the elaborated sap from the host-plants or (2) the haustorium may absorb the disintegrated products of bark and wood during the act of penetration.

The first theory may be supported by the fact that in all cases a certain percentage of the haustoria extends only as far as the cambium and never reaches the woody cylinder of the roots of host-plants. It is quite possible that these haustoria may function only as absorbers of the elaborated food materials or they may be abortive cases where the normal development of the haustoria has been interfered with. The second theory is more rational and may be assumed to be correct. In *S. Nux-vomica*, strychnine is found deposited in both the bark and wood, and the sandal haustorium must have absorbed it during the process of penetration.

This theory has an important bearing on the investigation of the spike disease in sandal. The sandal haustoria after it has ceased to function, leaves large open sores on the roots of host-plants. Considering that the sandal tree has a superficial root system, and that the bulk of its haustorial attacks on the roots of host-plants are found within a few inches of the soil-surface, it is obvious that any kind of infection from the soil will find suitable lodging in the numerous gaping wounds left by the haustoria—and I have several times come across, bacterial and fungoid growths in such wounds. The infecting virus may spread into the root or remain localised in the wound itself, but in either case, the sandal haustorium may absorb the poison, as new haustoria attacks often overlap old wounds, and the products of disintegration of wood and other organic matter met with are absorbed by the haustoria. The sores left on the roots of host-plants by sandal haustoria take a much longer time to heal than ordinary

bruises or cuts and hence are exposed to infection for a longer time. In the light of the above remarks, and the existing literature on the subject of the spike disease in sandal it may be presumed that the main channel of infection of the disease lies through the roots of host-plants.

The above inferences have been drawn on the basis that spike disease in sandal is infectious. It is the only rational theory that has stood the test of experience. It is a pity, that the theory of the unbalanced circulation of sap has led some of the investigators astray, and the sooner it is given up, the better it will be for unravelling the mystery of the disease. It is not perhaps generally known that the major portion of Mysore State is still free from the disease. If a straight line is drawn due east from the northern limit of Coorg, it cuts off all the spiked areas in and out of Mysore to the south of it. All country to the north of this line is still absolutely free from spike disease. About two-thirds of the Mysore State which includes the bulk of the sandal bearing areas in the State lies above this line, and no spike disease is found anywhere in this area though it presents a considerable variety of climate and the rainfall varies from about 300 inches on the Western Ghats to 24 inches in the eastern districts. If the spike disease is due to unbalanced circulation of sap, disease would have been found sporadically all over the State in places where the contributory causes are much in evidence. During the past five years I have been engaged in supervising the enumeration of sandal trees in the northern half of the state for the compilation of sandalwood working plans, and every day come across sandal trees, subjected to all conceivable kinds of injury and mal-treatment and yet not a single tree shows any signs of spike disease. About two thousand square miles of country have been traversed so far and over twelve lakhs of sandal trees enumerated out of which about sixty thousand trees are in dying state, most of them due to severe fires, destruction of host-plants and to the mal-treatment of the tree itself, which though considered the main causes which bring about the unbalanced circulation of sap, have not been able to cause the spike disease in a single instance.

I would like to suggest to the believers in this "unbalanced" theory of the spike disease that they should undertake an extensive tour in the northern half of the State and find out why the factors which are said to bring about the unbalanced circulation of sap, fail to cause the spike disease in sandal in the huge sketch of sandal areas extending over eighteen thousand square miles.

M. G VENKATA RAO,
Sub-A. C. F., Mysore State.

PARROTIA JACQUEMONTIANA FOR USE AS HAMMER HANDLES.

The investigation of *Parrotia jacquemontiana* for use as hammer handles was suggested by a query from the Divisional Forest Officer, Lower Hazara, and the work was begun on material supplied by him.

The investigation was divided into two parts, one a series of tests in static and impact bending of small clear specimens as near to standard size as this small timber would furnish, to use as a basis of direct comparison with American hickories and ashes, which have been tested in the United States by Standard methods, and second a test of a number of made-up *Parrotia jacquemontiana* handles to use as a basis of comparison with *Olea ferruginea* and other Indian woods already tested in the same manner.

The first series of tests mentioned above were made as soon as possible after the receipt of material, and it was possible therefore to test the material in a practically green condition. The advantage of this is that it makes the comparison with American species absolutely reliable, all the timber having been tested under the same conditions. Table No. 1 is a summary which shows the average strength values of the different species concerned.

TABLE NO 1.

	Moisture content	Specific gravity.	Transverse Strength.		M. of E. in 1,000 lbs.	Work to E. L.
			F. S. at E. L	F. S. at Max. load		
Parrotia jacquemontiana. ...	32 5 %	·694	3,867	9,425	1,069	·73
Ash, biltmeren.	42 °/o	·51	5,500	9,300	1,340	1 31
Ash, black. ...	83 °/o	·46	2,600	6,000	1,020	·42
Ash, white. ...	43 °/o	·52	4,900	9,100	1,350	1·0;
Hickory bitternut	66 °/o	0·60	5,500	10,300	1,400	1·22
Hickory mecker-nut.	59 °/o	64	6,300	11,100	1,570	1·38
Hickory nutmeg.	74 °/o	·56	4,900	9,100	1,290	1·06
Hickory pecan.	69 °/o	60	5,200	9,800	1,370	1·18
Hickory pignut.	54 °/o	·66	6,200	11,700	1,650	1·34
Hickory shagbark	60 °/o	·64	5,900	11,000	1,570	1·28
Hickory shellbark	61 °/o	·62	5,600	10,500	1,340	1·36

For the second series of tests mentioned above the material was seasoned and made up into hammer handles of the same type as were formerly used in tests of *Terminalia tomentosa*, *Dalbergia sissoo*, *Olea ferruginea* and other timbers. Although it would be preferable to compare the strength of these timbers on the same basis as the results presented in Table No. 1, this is impossible because such results are not yet available for these timbers. For this reason Table No. 2 is prepared, which will give a direct comparison of the species in question when actually tested as hammer handles. Table No. 2 presents these results.

TABLE NO. 2.

Species.	Moisture % of weight of drywood.	Static Bending.		Impact Bending.	
		Fibre stress at elastic limit pounds per sq. in.	Modulus of rupture pounds per sq. in.	Fibre stress at elastic limit pounds per sq. in.	Height of drop of 50 lb. weight causing failure.
Terminalia tomentosa.	12	13,315	18,980	35,670	9·77 in.
Dalbergia Sissoo ...	12	11,000	17,770	37,380	12·87 ,,
Parrotia jacquemontiana.	12	12,325	21,430	26,085	7·4 ,,
Anogeissus latifolia	12	10,590	20,735	32,875	8·2 ,,
Schleichera trijuga	12	8,445	17,260	35,005	8·0 ,,
Olea ferruginea ...	12	8,000	21,460	35,180	9·3 ,,

In the case of axe helves, hammer handles, and similar tool parts which are subjected, as a rule, to a sudden strain but are not called upon to carry sustained loads the fibre stress at maximum load, (modulus of rupture), is of more importance than the fibre stress at elastic limit. Considering table No. 1, it will be seen that in both fibre stress at elastic limit and fibre stress at maximum load *Parrotia jacquemontiana* compares favourably with the American ashes and hickories, while its comparatively low modulus of elasticity renders it, if anything slightly less liable to breakage than the American species. It should, therefore, make a satisfactory axe helve wood and at least be well worth trying for the purpose.

Considering also table No. 2, which presents the results of tests made on handles of seasoned wood from specimens containing the same amount, namely, 12 per cent. of moisture, it will be found that *Parrotia jacquemontiana* gave extremely good results. Its lowest value was in impact bending, but it must be pointed that the number of tests of this particular nature was small, and that material available for these tests, after the other tests had been finished, was of rather inferior quality. The

indications are that *Parrotia jacquemontiana* should be at least as good as, if not better than, *Olea ferruginea*, which has already proved a satisfactory tool handle wood in practical use.

Combining the results of both tables and considering them in the light of notes made on the nature of the material and the nature of the failures during the tests, it is considered that *Parrotia jacquemontiana* will be found to make a very satisfactory wood for axe helves, hammer handles and the like.

Forest Research Institute,
Dehra Dun.

L. N. SEAMAN,
O.-i.-C., Timber Testing.

THE UNEXPECTED EXTENSION OF AN UNDESIRABLE TYPE OF FOREST.

In the locality to which the following remarks apply are several different types of forest such as—

(1) Pure or nearly pure *sal* forest.
(2) Pure or nearly pure bamboo forest.
(3) Bamboos mixed with miscellaneous species, *i.e.*, *Terminalia tomentosa*, *Adina cordifolia*, *Anogeissus latifolia*, etc.
(4) Type 3 *sal*. Bamboos are somewhat less than in 3.
(5) *Bambusa arundinacea* either pure or mixed with miscellaneous species.

These are the main types, but the growth varies so much that it is quite easy to classify each of these types to two or three sub-types. For the purpose of this note we are concerned only with type No. 4. This type consists of scattered *sal*, *Terminalia tomentosa*, *Adina cordifolia*, *Anogeissus latifolia* and other species, which are not utilised at present—mixed with *Dendrocalamus strictus*. Though this bamboo is fairly common in this type of the forest it is not so abundant as in type No. 3, nor has it been able to make much headway against the tree-growth as it has done in type 3. The growth of *sal* and other species is quite good. The Working Plan which expired two years ago prescribed the usual selection and improvement fellings

for part of the area and improvement fellings only for the rest. In certain portions where the stock appeared to be good twenty years ago, *sal* trees were enumerated while in the rest of the area which appeared to be poorly stocked with *sal* no such enumerations were carried out. In the former a fixed number of *sal* trees over a certain girth were to be felled annually, while in the latter no fixed number of trees was prescribed, but it was simply laid down that fellings were to be done by area. In the former case marking was to be done under Selection and Improvement method, while improvement fellings only were prescribed for the latter. A set of marking rules, mainly for regulating the marking of *sal* was given in the Working Plan. Though it was laid down that *sal* should be given preference to all other species and the *sal* area further extended, no definite proposals were made to attain that object. As there was and is still no great demand from these forests for *Terminalia tomentosa*, *Adina cordifolia*, etc., it was not thought worth while to lay down any definite lines on which these species were to be treated. It was however implied in the Working Plan that trees other than *sal* should also be removed if there was any demand for them, and also to generally improve the *sal* crop.

Under the selection method only *sal* trees were marked, while all sorts of trees, removal of which was considered necessary to improve the stock, were marked under the improvement method. In the area where enumerations were done there was a very large number of *sal* trees both young and mature. As it was definitely laid down that a certain number of *sal* trees must be marked annually, there was no alternative for the marking officer but to carry out this order. It has already been pointed out that there was little or no demand for trees other than *sal*—especially from the interior on account of heavy transport charges— and as there was no obligation to mark any trees except *sal* under selection method, the marking officer, after he had marked the total number of *sal* trees prescribed in the Working Plan, either declared the marking to be over or sometimes marked a certain number of miscellaneous trees, merely to show that some trees have been marked under improvement method also. The coupes

thus marked were auctioned annually. The purchasers regulated their bids according to the number of *sal* trees marked in each coupe ignoring all the other marked trees altogether. This method of marking and the disposal of coupes has now gone on for fifteen years.

A word might also be said about the way the trees were disposed of before the Working Plan was put into force. It is an admitted fact that the nature of rules and regulations for the disposal of trees depends a good deal on the demand. If the demand is slack these rules have to be very liberal and if it is altogether absent and has to be created, then at times it becomes necessary even to go against sylvicultural requirements. Twenty to thirty years ago such were the circumstances in Angul, that special messengers had to be sent to induce the purchasers to start timber business in these forests. No local people were available. After a good deal of hunting a contractor from outside was found agreeable to work in these forests at that time described as the most inaccessible in the whole of Bengal. He was given a free hand to select trees for felling in a particular locality, which had to be in the vicinity of the main line of export. As was to be expected this purchaser would not look at anything except *sal*, and, when any of the trees selected was found out to be hollow or defective after felling, a substitute was given. This went on for several years.

Sometimes "dry" *sal* trees were sold in a compartment after the main fellings had been completed. These trees were selected by the purchasers themselves and then marked by a subordinate. Some of these trees were actually dry, but all those trees about which there was some "doubt" as to whether they were "dry" or not were also taken as dry and not unfrequently they were really green.

As the revision of the Working Plan is in progress it is an opportune time to see whether the objects of management, *i.e.* the preference of *sal* and the further extension of *sal* area have been attained in Type No. 4 forests :—

1. *Areas subject to selection and improvement method.*

If a trained forester who was here fifteen years ago was to come back to-day, he will not take long to notice the transforma-

tion these areas have undergone during his absence. He will find that the proportion of bamboos to tree-growth has increased. The thing he will miss most is *sal*. The purchasers have felled most of the marked *sal* trees—leaving only unsound ones—and left most of the marked miscellaneous trees standing. There was no obligation on the part of the purchasers to fell all the marked trees, so they removed only the best of the *sal* trees and left everything else standing. The result of all this has been that most of the area which was type No. 4 fifteen years ago has now become type No. 3. In other words the Forest Department with the willing assistance of the purchasers has converted a forest containing *sal*, miscellaneous species, and bamboos to a forest containing miscellaneous species and bamboos. The value of these forests in this particular locality depends upon the presence of *sal*, and both these parties have helped one another to eliminate it from a portion of this division. Whether this result had been foreseen in the beginning or not it is not clear; the Working Plan shows no indication that it had been. If it was, then an addition of one simple clause in the standard High Forest Agreement, namely, that all marked trees must be felled by the purchasers would have helped to preserve the chief characteristics of these forests. This clause would have compelled the purchasers to fell all the marked trees whether *sal*, *asan* or any other. If they failed to comply with this condition, then the department would have undertaken the felling of the marked trees left by the purchasers and charged the latter the expenditure incurred. This condition has now been introduced and it is hoped that it will have the effect of preserving type No. 4 and at the same time extending *sal* area.

2. *Areas subject to improvement fellings only.*

The main object here was to improve the stock. As there was very little *sal* in this area and the soil so unsuitable for it that extension of the *sal* area was neither practicable nor desirable; and though the Working Plan did not say so clearly it was implied therein. For the same reason as given above the purchasers removed the best of the marked trees and left all the unsound marked trees standing. One could imagine the condition of the

crop after 15 or 20 years of work on the above method. The result has been absolutely the opposite of what was desired. While at the start there was a very large number of sound and straight trees which outnumbered the crooked and unsound ones, now after twenty years of work the proportion of the latter class of trees has actually increased.

In conclusion, I must make it clear that the above lines have not been written with a view to criticise the past management. The conditions in this locality were such that no better system could have been adopted. As a matter of fact great credit is due to the past Forest Officers, who made strenuous efforts to induce the people to start timber work here at the time when everybody except perhaps the forest staff was afraid to visit these jungles on account of their being inaccessible and unhealthy. Unless special facilities were allowed, as they were, to the purchasers, there was no hope of exploiting these forests at all.

L. R. SABHARWAL, I. F. S., B.Sc.

THE IMPERIAL FORESTRY INSTITUTE, OXFORD.

The present year will see the beginning of what should prove to be a great development in Forestry training and research, with the establishment at Oxford of an Institute which will be known as the Imperial Forestry Institute, a title adopted at the command of His Majesty the King.

The question of establishing a central training institution was first discussed by the British Empire Forestry Conference in 1920. This Conference felt that, owing to lack of funds and dissipation of effort, training in the higher branches of forestry for the needs of the Empire was nowhere as complete or efficient as was desirable, and therefore recommended the establishment in the United Kingdom of one institution which should undertake the higher training of forest officers and should also be a centre for research into the formation, tending, and protection of forests. An impartial Committee, consisting partly of representatives of Government departments concerned and partly of experts, was thereupon appointed to make recommendations regarding the

location and organisation of such an institution, and other matters. After visiting the Universities of Oxford, Cambridge, Bangor and Edinburgh, and also taking evidence from other Universities, as well as from Institutions and Societies interested in forestry, this Committee issued in 1921 a report, which recommended the establishment at Oxford of a central institution for the higher training of forest officers, for training in research, for the provision of special and 'refresher' courses for officers already serving, and for the conduct of research into forest production. The report made it clear that there was no intention of interfering with the work done by the various University Schools of Forestry, and, provided the training of these was maintained at a required standard, selected students from any such schools would be eligible for admission to the central institution. Full details will be found in the Report of the Inter-departmental Committee on Imperial Forestry Education, 1921 (Command Paper 1166).

Further action was suspended until 1923, when the proposals of the Inter-departmental Committee were considered by the British Empire Forestry Conference in Canada. The Conference supported them in the strongest terms, and they were subsequently endorsed by the Imperial Economic Conference held in London the same year. Arrangements have accordingly been completed for starting the Institute in October 1924.

The Imperial Forestry Institute will be a University Institution, the Professor of Forestry being its Director. It will be under the control of a Board of Governors representing the University and Government Departments concerned, under the Chairmanship of Lord Clinton, a Forestry Commissioner. The educational work of the Institute will comprise (1) post-graduate training of probationers for the forest services and of other qualified persons, (2) training of research officers in special subjects and (3) provision of courses for selected officers already serving. It is intended that the Institute should maintain close touch with and be of assistance to the various forestry training centres throughout the Empire. Thus, in the case of overseas training centres which have no direct means of giving practical instruction in the latest systems of management as practised on the continent

of Europe, it will be one of the functions of the Institute to arrange for such practical instruction to be given by members of its own staff to students who have already completed their general course of training at their own Universities or Colleges.

If in any particular case it cannot undertake to give direct instruction, the Institute may arrange that this should be given at some other place. It is proposed, for instance, that close touch should be maintained with the Royal Botanic Gardens, Kew, whose unrivalled resources should be of great assistance to those students who may wish to study systematic botany and economic products. Again, forest engineering is a subject which cannot be dealt with comprehensively in Great Britain, owing to the absence of logging operations on a large scale; arrangements will therefore be made as far as possible to study it practically in the forest regions of the Continent, or in certain cases in Canada. Similarly, the study of tropical silviculture from the practical point of view is impossible outside the tropics, and hence the Institute will maintain close touch with other institutions where this subject can be efficiently dealt with, such as the Forest Research Institute and College, Dehra Dun, in order that the best possible arrangements may be made in the interests of students who wish to make a practical study of tropical silviculture.

Although the Institute is intended primarily to serve the needs of Forestry in the British Empire, it will be open to qualified students of any nationality provided that there is sufficient accommodation. Nor is it by any means intended that it should cater only for the requirements of State forest services; now that timber and wood-pulp firms are becoming more and more interested in the management and working of forests on scientific and economic lines, the Institute should be of special value in providing them with fully trained employees. Students admitted to the Institute may, in fact, be included under any of the following categories :—

(a) Those possessing a Degree in Forestry, or a Diploma or equivalent certificate of having satisfactorily completed an approved course of training in forestry, who have been selected as probationers for the higher branch of some forest service.

(b) Graduates with honours in Science, who desire to become specialists in some branch of work connected with forestry.

(c) Forest officers deputed to attend courses with the view of bringing their professional knowledge up to date.

(d) Students of approved qualifications not included in the first three categories, who are admitted on the recommendation of overseas governments.

(e) Students with a University training in forestry who may wish to attend the Institute on their own account and at their own expense.

The course of study at the Institute will normally extend over one academic year, beginning October, and will be made sufficiently elastic to serve the needs of individual students. The subjects dealt with will cover the whole range of Forestry, and will include Silviculture (European and Tropical), Forest Management (including Mensuration, Valuation, and Working Plans), Forest Botany (including physiology and anatomy of trees, mycology and pathology, ecology and systematic botany), Forest Zoology (including entomology), Forest Utilization (including the structure, properties, and uses of wood), Soils, Climatology, Forest Economics and Policy, Forest Law, and Forest Engineering including Surveying.

Temporary accommodation for the Institute has been arranged, but a more suitable site and larger buildings will be necessary, and the formidable task of obtaining funds for the acquisition of a site and the erection of buildings will fall on the University. The requisite sum for this purpose will be far beyond the means of the University to provide, but a building fund is being started, and it is hoped that this great undertaking will not suffer from lack of support on the part of benefactors who have at heart the welfare of the Empire in general and the cause of Forestry in particular.

THE EMPIRE FORESTRY ASSOCIATION.

In the July issue of this journal there appears a lengthy account of the progress of this Association, and the impression

conveyed is that the society has now been established on a very sound foundation everywhere except in India.

Since the creation of the Association in 1920 the *Indian Forester* has published notices of its activities. Nothing however appears, as yet, to have been initiated for the benefit of this country.

That the people of India are not wholly without interest may be seen by a reference to the list of members, which includes a number of our princes and other Indians. Some action had been anticipated from Dehra Dun, but an enquiry reveals the fact that it has been expecting inspiration from above, and it appears that the formation of an Indian Forestry Association had actually been contemplated with a view to eventual affiliation with the main Empire institution The idea appears to be an excellent one. India is sufficiently large to support its own society while in matters of forest organisation, management, research and education it takes pride of place in the Empire. For political reasons alone the creation of an independent body is urgently required, as the legislators and the masses both require constant and energetic measures to ensure a correct realisation of the part taken by forestry in the domestic economy of the country.

It has been seen that already in one province a local clamour, aided by incendiarism, has resulted in the reversion of a policy, which aimed at the preservation of forests reserved for direct benefits to the local population and indirect benefits to the country at large. There is nothing to prevent a similar agitation arising almost anywhere, and the corrective lies in a well-informed public opinion, which alone can effectively suppress agitation not based on a correct appreciation of facts conected with forests but upon a selfish disregard of all consideration for others.

It must be remembered that the policy of forest conservation was imposed on the country at a time when public opinion was inarticulate or non-existent. A natural reaction has now set in against all enactments, however beneficient which were thus, autocratically brought into force. An unofficial organisation is therefore the best means of overcoming administrative difficulties

particularly in this country, wherein all political creeds are allied against the Government. The opportunity afforded through an Association to official and non-official elements of meeting on a common basis cannot fail to be of mutual benefit to both parties. There can, therefore, be no question of the desirability, or indeed necessity, of India organising a body which can bring into prominence the interests to the country and to its people of the maintenance of the forest estate,—an estate which covers nearly a quarter of the area of the country. A free discussion of all problems, aiming at the welfare of the people, can only lead to a better understanding, while the departmental and technical staff have an obligation in making known all facts which will induce others to realise the valuable nature of the forests and their products, not omitting to reveal such efforts as have been or are being taken to develop the resources of the forests to their maximum. Government can issue propaganda on its own, and already much literature is available, but it is evident that all attempts made in this direction are either too technical or are treated with suspicion and therefore fail in their object.

It must obviously be conceded that the creation of an Indian Forestry Association is desirable and it follows that there is no time like the present. The question then arises how to proceed. Clearly the send-off must be official and it is justifiable, in view of the public interest at stake, to spend money from public funds until such time as the Association can support itself and become independent. The suggestion is to place the matter in the hands of the head of the department, whose position at headquarters and whose influence with all concerned, should afford him special and unrivalled opportunities of performing this task. His functions have been much restricted, but he is still the principal link between the Government of India and Local Governments or even between Local Governments. His ability to tour throughout India also places him in the necessary commanding position, and he can therefore become the principal means of furthering this object. Much has been heard of the abolition of the highest post in the department, but if it be recognised

that it is part of the functions of the incumbent to influence public opinion in forest matters, and with that object inaugurate and firmly establish an Indian Forestry Association, there will be ample justification for the retention of the post for this object alone. Given the acceptance of this axiom the rest can be left to the energy and ability of the man elected to the highest prize the department offers.

YOUNG HOPEFUL.

MIDSUMMER MEMORIES.

[We re-open our Poets' Corner with two laments inspired by last hot weather. As the cold weather is now in sight we think the venture is justified.—HON. ED.]

A HOT WEATHER FANTASY.

(With a thousand apologies to Stephen Leacock.)

The Punkah's bust; and gasping in the heat
I dream of hillmen in their quiet retreat.
Surely no nobler theme the poet chants
Than the soft science of the blooming plants.
How sweet it were in some sequestered spot
To classify the wild forget-me-not,
To twine about the overheated brow
The coolness of the rhododendron bough,
To lie recumbent on a mossy heap,
And draw my salary whilst fast asleep.
If only I could live in Naini Tal, I
Could even love *Diospyros Kanjilali;*
Or gazing on the placid lake afar
Would dally with the gentle *Pisso Mar** ;
Or make of shrubs and ferns a classic list;
Or give the *chir* a really champion twist;
Or e'en with sex of deodar, I rouse could
The trenchant pen of prophet-loving Trowscoed.
If only I were cool I'd be no coward;
I'd argue back-chat methods out with Howard.
Or getting playful without any reason

---

* *Auta nepalensis*, the "flea-killer."

I'd soo the beehole borer on to Beeson.
But sweltering in this rest-house chair I hate,
It's made my poor old base quite cuneate.
And now I think I'd best conclude my song.
The men at last have spliced the punkah thong.

MAKOMAKO.

THE BOMBAY FOREST ALPHABET.

(*At 120° in the shade.*)

A is an auction, where prices are high,
B is a Bidder, refusing to buy,
C, a Contractor, who cannot get carts,
D is a Depôt, where work never starts,
E is an Engine, gone *phut* in the Mills,
F is a Forester, lost on the hills,
G is a Grouse (a most flourishing bird),
H is a *Hookum*, which nobody heard,
I 's an Incendiary, idling around,
J is a Jungle, where insects abound,
K is a *Koonbie*, destroying the trees,
L is the Lack of the longed for rupees,
M is for *Murrum* (we've none for the road),
N is a Nullah, too steep for the load,
O 's your Opinion,—and no one wants *that*,
P, a Plantation,—where cattle grow fat!
Q are the Questions folk ask more and more,
R, the Reports you must write by the score,
S is the Scheme which you want to push through,
T is the *Takra* there'll be if you do,
U is the Utilisation of scraps,
V is the Village not marked on the maps,
W is Wifey, left lonesome and sad,
X is for Xmas,—so let us be glad!
Y is your Yell when your pay-bill you see,
Z—is a *Zizyphus Jujuba* tree.

F. D.

REVIEWS.

FOREST ADMINISTRATION IN BURMA.

REVIEW: THE REPORT ON FOREST ADMINISTRATION IN BURMA FOR 1922-23. Rangoon, 1924.

For the first time the report appears in a convenient size and one much less forbidding than the old foolscap blue book.

The report covers the first of the lean years, which were bound to succeed the fat times of the post-war boom. The drop in revenue of 37 lakhs as compared with the previous year shows the reaction in sympathy with the slump in trade all over the world.

Progress in all branches continued steadily on the lines of the previous year, but the general tone of the report shows that the time for reconsideration and consolidation has arrived.

Considerable space is devoted to the subject of Working Plans. The results of the centralising of execution and control under the New Working Plans Circle begin to show, and the figure of 3,157 sq. miles actually in hand for revision or original work is vastly bigger than any recorded in recent years.

The Conservator, Working Plans Circle, sounds a note of warning as to the neglect of control in Girdling and Improvement Fellings, and its future effect on the revenue of the province. Everyone will agree with them in principle, but it is clear to those with inside information that Sylvicultural work is bound to suffer while so much of the Forest Officer's time is taken up with office and revenue work. The future will have to pay dearly for the revenue now obtained from unclassed forest, which amounts to 30% of the total forest revenue.

The same theme is developed at greater length under the head of Sylvicultural Research. The subject is out of place under such a caption, since it seems, clearly to be one of fundamental forest policy appertaining to the Government as a whole than as a question of Research.

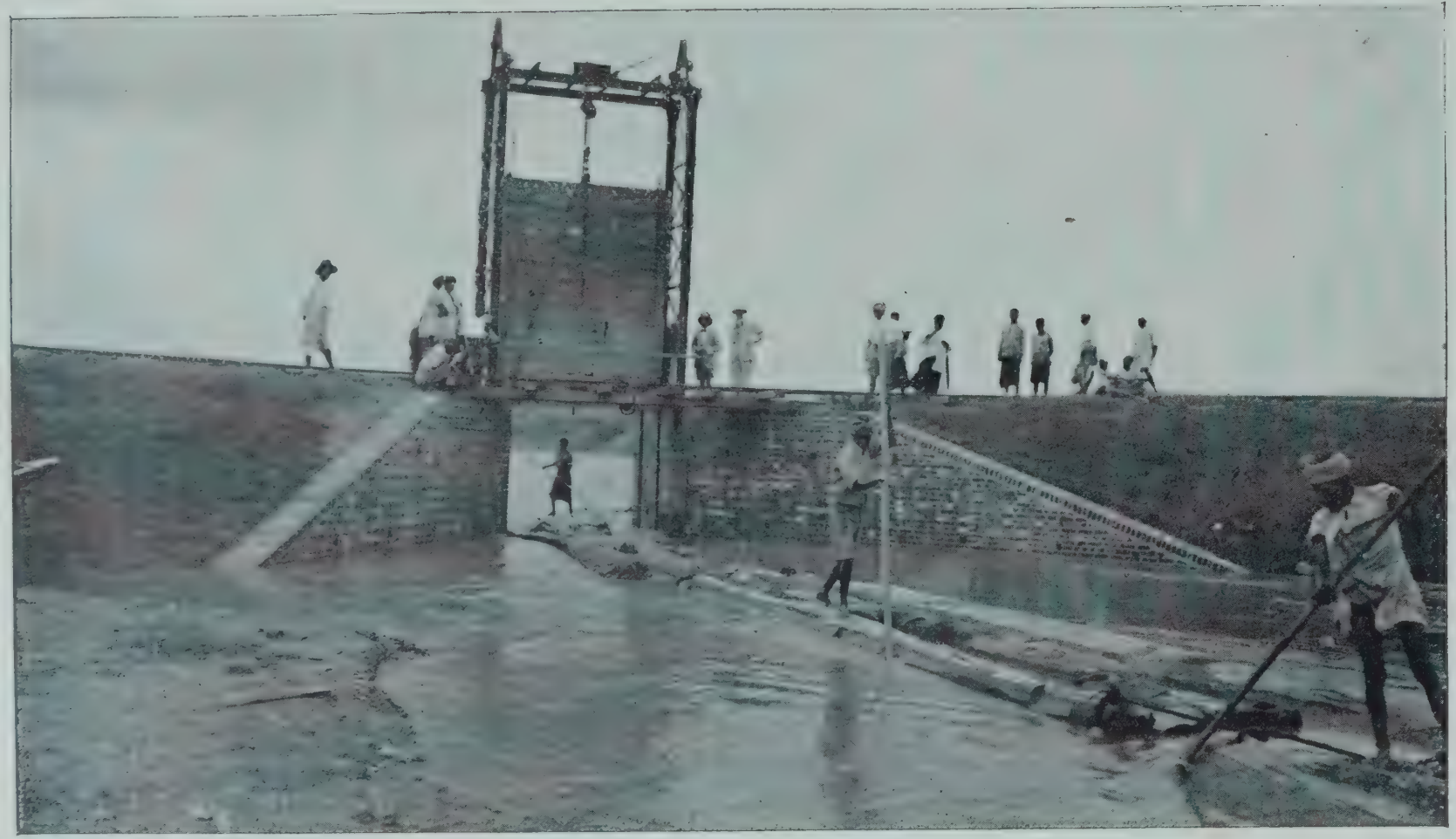

Photo.-Mechl. Dept., Thomason College, Roorkee. Photo by J. D. Hamilton, I.F.S.

Government Timber Depot, Rangoon. Poling logs from the Rangoon River into one of the new Sale Ponds recently constructed.

(From Report on Forest Administration Burma, 1922-23 ; by permission).

Taungya plantations have all along been one of Burma's chief Sylvicultural achievements, and the increase of over 6,000 acres during the year indicates steady progress, but the provincial Sylviculturist wisely inveigles against the lack of system in planting and the absence in too many places of planting schemes. This has long been the weakest point in Burma's Sylviculture. It was this lack of system, which brought plantations into disfavour in about 1906, and one may suppose that this drawback had been forgotten during their sudden return to favour in the last few years.

From Sylvicultural Research the report continues with Research in Utilisation, but these sections read more as an exposition of the objects of Research than as a record of results achieved and in this respect are disappointing. So also is the information that the Forest Museum no longer exists. The words....." The specimens which have gradually been collected since 1916 are now stored in the office of the Conservator, Utilisation," sound ominous ; they call to mind dingy exhibits with fading labels stored in dusty cases in some dark corner, a sight to chill at once all interest in forest products.

Exploration and Engineering receive a large share of attention and, to judge from the photographs, road-making has become much more elaborate than in the past, but we find no indication of any general policy of development.

Departmental extraction of teak with its accompanying river training works progresses successfully, though with a drop of Rs. 37 per ton in two years in the auction price of teak it can no longer be the absolute gold mine to Government that it used to be.

In some ways its very success has been a misfortune to the Department. The attention of the financial authorities has become focussed on this one branch of the Department's activities much to the detriment of the rest. In this connection the Chief Conservator's analysis on p. 43 of the real budget position makes interesting reading, though it is depressing to realise that, although Forestry has been practised regularly for over fifty years in the Province, the authorities responsible for the budget allotments are still either completely ignorant of or deliberately ignore the

basic principles of forest finance. One-third of the total revenue was obtained from unreserved forests, *i.e.*, from produce which will never be replaced, yet less than one-third of the total expenditure on works was spent towards future revenue, that is towards replacing this year's revenue from reserves and increasing the capital value of the forests to make good the used-up unreserved forest.

We welcome the illustrations to the report again this year, though the actual reproduction does not seem quite so good as in the preceding one. These photographs should go some way towards making the report appeal more to the general public, but would it not be possible to publish a booklet containing the narrative and perhaps Appendix H only for general circulation reserving the rest for purely official use?

THE GROWTH AND REGENERATION OF PINE FORESTS IN CALIFORNIA.

SOME RESULTS OF CUTTING IN THE SIERRA FORESTS OF CALIFORNIA, by DUNCAN DUNNING, U. S. Department of Agriculture, Bulletin No. 1176, November 24th 1923.

The object of the study resulting in this bulletin is to determine cutting methods for the Sierra Forests of California, that will secure adequate reproduction and retain desirable advance reproduction and immature timber for its growth after cutting. Four forest types were studied, namely, pure western yellow pine; yellow pine—sugar pine; mixed yellow pine—sugar pine, Douglas fir, white fir, incense cedar; and sugar pine—fir. Results are to be used as a basis for revision of marking rules and a building up of good "silvicultural practice" for that region.

Conclusions are based on periodic observations and measurements of 25 sample plots, totalling 300 acres and 13,000 trees, established in 1911 on National Forest cut—over areas in the Sierra Belt near Mt. Shasta. The plots were distributed over as many variables of site, type, and degrees of cutting as offered by the region and cutting methods in vogue at that time.

Photo.-Mechl. Dept., Thomason College, Roorkee. Photo by E. W. Carroll, I.F.S.

Stacking teak squares by elephants in a Moulmein sawmill.

(From Report on Forest Administration Burma, 1922-23 ; by permission).

Dunning takes up first the growth of stands remaining after cutting and lists the influencing factors in order of their importance, as follows: "Site, species, size and age, crown size and form, degree of cutting." He has prepared tables showing growth per cent. as affected by variations of the above factors.

"On sites 1 and 2 a reserve volume is justified for increased growth and improved quality of second cut," but on site 3, or poorer, accelerated growth was in no case sufficient to justify reserving merchantable timber for this purpose, and cutting should aim to secure reproduction only.

"White fir ranks first in rate of growth, followed by sugar pine, Douglas fir, yellow pine and incense cedar. Sugar pine maintains a high rate of growth to a greater age and diameter limit than other species." The rate of the released growth was found to vary more in proportion to length of crown than to any other crown characteristic. It is interesting to note that Chapman found this to be the case in longleaf and loblolly pine of the South, and it seems probable that this may hold true in conifers of all regions.

The author brings out forcefully the rather elementary silvicultural facts that no acceleration of growth occurs in groups of trees after cutting where there has been no cutting in the interior of the group, or in open-grown stands where no competition existed before cutting. He states more specifically, however, that "no acceleration is observable unless trees are removed within 50 or 60 feet" of the tree reserved. The exact relation between degree of cutting or release and amount of accelerated growth seems to have been obscured by uncontrolled variables on the plots studied.

The discussion on reproduction emphasizes great necessity for taking all possible care to preserve reproduction already on the ground before cutting it, because of the difficulties and length of time involved in securing reproduction after cutting. These difficulties are attributed to "drought and infrequency of seed crops on poor sites," and on the better sites to competition with vegetative ground cover, insufficient opening up of the stand by

cutting, and infrequent seed crops. It is recommended that the present practice of piling and burning brush be abandoned, the contention being that burning results in " covering by fire of at least 6 to 10 per cent. of the area, on which a considerable number of seedlings and saplings are destroyed," and " that areas covered by fires are rendered unfavourable to establishment of seedlings for several years." Although the author admits that " exposure of mineral soils and openings created by fire favour yellow pine" he advocates that piling and burning of brush be dispensed with for the region as a whole. Pearson in the southwest recommends general piling and burning of brush in yellow pine type. Apparently the loss of yellow pine reproduction by burning brush in the Sierra region as a whole offsets any advantage gained by opening up seed beds of mineral soil.

In conclusion, figures are exhibited to show that after all, on areas devoid of advance reproduction, restocking by artificial planting would be less expensive than depending on natural reproduction, when all costs and values of each method are considered.

E. W. HADLEY,
Forest Examiner,
U. S. Forest Service.

THE NATURAL REGENERATION OF DOUGLAS FIR.

THE NATURAL REGENERATION OF DOUGLAS FIR IN THE PACIFIC NORTHWEST, by HOFMANN, J. V.; U. S. Department of Agriculture, Bulletin No. 1200, 63p., pl., maps, diagr, 1924.

A new Bulletin of the U. S. Forest Service covering the Natural Regeneration of Douglas Fir in the Pacific Northwest by Dr. Julius V. Hofmann of the Wind River Forest Experiment Station, has just been issued. (United States Department Agriculture, Bulletin 1200). In this bulletin the conditions that control the natural restocking of Douglas fir *(Pseudotsuga taxifolia)* orests after forest fires and after logging and slash-burning are analysed and the underlying principles are worked out for the first time. The studies conducted by the experiment station led

to new discoveries in the field of forestry that mark a new era in the management of the forests of the Douglas fir region of the Pacific Northwest and have been found to apply in other regions where they have been checked, such as in Canada, in the eastern United States, and in India.

The explanation of the dense stands of young Douglas fir growth after disastrous forest fires and after slash fires, and the barren areas where the land has been reburned, was found in the characteristics of the seed and the provisions of nature in insuring a supply of seed in the forest floor at all times.

It was found that Douglas fir seed retains its viability or eight years when stored in the forest floor, and many instances were found where the seed has lasted much longer. Large quantities of seed are stored in the forest floor after every seed crop and remain there awaiting the removal of the forest and favourable conditions for germination.

Where stands of young growth are destroyed by fire before they have reached the seedling stage, there is no source of seed and the restocking of the area depends upon the seeds produced from the nearest seed trees. For this reason a second fire causes barren areas.

Through relatively simple and cheap measures, it is possible for the lumbermen to insure a continuous supply of forest for their operations. The chief one is the prevention of fire after the slash has been burned over. Present cutting and logging methods need not be changed, although the methods of slash disposal should be systematised in order to insure the proper kind of burning and at the right time.

E. N. M.

THE MADRAS FOREST COLLEGE MAGAZINE.

The fourth number of volume VIII, issued in June 1924 contains a note on the Parlakimidi forests by W. O. Newsam, I.C.S. Regeneration operations in the Dhoni forests are described by K. P. Rajalingam, and exploitation operations in the same area are described by B. H. Ananda Rau. S. Rangasami chooses the

sandal tree as his subject for the *Indian Forester* prize, and M.R.Ry. A. Seddan Pillai wins the Chief Conservator's prize with an essay on the management of village forests. A specimen field book of a prismatic compass survey is provided by M.R.Ry. C. M. Kushalappa. A lecture on forest management is printed by C. E. C. Fisher.

THE CORNELL FORESTER.

We have been favoured with a copy of the *Cornell Forester* (Vol. 4, 1924), that is published annually by the foresters of Cornell University. It is a pleasing production encased in a high-art cover and printed on a grade of paper, that permits half-tone illustrations in the text. The preparation and publication of a year-book or annual is a custom that has arisen in a number of forestry schools in the United States. It is usually the work of a committee of the Forestry Club, and is a good index of a developing appreciation of the *esprit de corps* that is so characteristic of the profession of forestry.

We quote the words of Prof. Ralph S. Hosmer on the variety of character and make-up in the literary productions of forestry schools ....." Some are fairly pretentious publications, with many illustrations and often carrying no little advertising matter. Others are much simpler in form although not infrequently of as great interest and value as regards their contents. In the character of the articles, too, there is wide variation. Some of the annuals are frankly and unblushingly the work of the under-graduate body, and are devoted to stories, jokes, verse, and pictures, that chronicle the life of the school during the preceding year. Some go to quite the other extreme, and carry carefully written contributions by graduates or other older men in the profession, that are wholly worthy of a place in the *Journal of Forestry*. Others again strive to attain a happy balance between these two extremes, by a judicious mixture of serious articles by alumni and others, with perhaps more spontaneous contributions from the resident student body. It would be captious to contend that anyone of these types is better than the rest. Each serves the local need....."

The ideal before the editorial staff of the *Cornell Forester* may be judged from its list of contents :—Forestry students and Economic Studies ; The story of Axton (a historical account of the first systematic experiment in forestry in the States) ; Utilisation of Forest Products—Its Place in Forestry ; Seeing the Northern National Forests from a Ford ; Alaskan Experiences ; Glimpses of Summer Work in the "Service ;" Growth Study for Finch, Pruyn and Co. ; In Preparation for Fire Protection ; A short Talk about Bamboo in China ; Murph's Missive ; Cornell Forestry Camp, 1923 ; The Year in Club History, etc., and several fragments of verse.

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We turn to the inside of the cover of the *Indian Forester*, which we find described in pseudo-gothic type as "A monthly Journal of Forestry, Agriculture, Shikar, and Travel "—and we wonder why.

WORKING PLANS OF THE UNITED PROVINCES.

(1) SAHARANPUR FOREST DIVISION, 1923 TO 1933, by E BENSKIN, M.A., I.F.S. ; (2) SOUTH KHERI FOREST DIVISION 1923-24 TO 1932-33, by KESHUB DUTT JOSHI, B.SC., P.F.S.; (3) DEHRA DUN FOREST DIVISION, 1923-24 TO 1932-33, by MATHURA PRASAD BHOLA, I.F.S.; (4) NORTH KHERI FOREST DIVISION 1923-24 TO 1932-33, by F. E. CHETWYND PALMER, P.F.S.

As this is the first batch of plans completely compiled under the auspices of the Working Plans Circle, U.P., they have been awaited with much interest. With the exception of the Saharanpur plan, the others have all been received during the current year and for want of space have perforce all to be reviewed together. This hardly enables a reviewer to do justice to a plan for he can then only touch on the most striking points. All this short review can do is to examine the methods of calculating the yield and rotation and the purely silvicultural matter, and it must leave aside all comments on other—though, very important—points such as roads, buildings, staff, etc.

The calculation of the yield is an extremely important matter. The roughest of calculations would have convinced the Americans that they were overfelling and squandering national wealth and Brandis's very rough method saved the Burmese teak forests. No forester will argue, we presume, if we say that the prevention of overfelling and depletion, or if necessary the building up, of forest capital is the first duty of a working plan, as important as good silviculture, though once such a safeguard has been applied, good silviculture is much the more important matter and the yield calculation is merely to show what may be taken if silviculture permits it.

As C. G. T. writes in the *Indian Forester*....."The beginning and the end of the whole matter is to found our management on the teachings of nature and the silvicultural requirements of every individual species in its special environment, *leaving mathematics to occupy its appointed place as the servant and not the master of silviculture* which must remain the dominating force of all real forestry."..... The italics are ours. We commend those words to the Working Plans Circle, and would add that if a man cannot control his servants he had much better do without them. This first essential—the safeguarding of overfelling—appears to have been neglected in some of the most important working circles of these plans.

The Saharanpur plan need not be criticised, though there is a statement in para. 125 that "the rotation of the greatest M.A.I. for Quality IV *sal* forest is over 90 years." If this means timber we should like to see the figures to prove it. The truth is nearer 130 or 140 years (if the trees remain sound) but perhaps 'over 90 years" means that.

In the South Kheri plan, para. 64, it is calculated that 600,000 cubic feet may be felled annually. The enumeration figures for P.B.I. show that the relation between the diameter classes is.—

20″—24″	16″—20″	12″—16″	8″—12″
	2·04	4·75	7·21

This is then apparently still a selection forest in form, and most of the 8″—12″ trees must be dominated or suppressed. Increment figures for a regular crop are therefore inapplicable, and if applied the largest error will be in these very 8″—12″ tree. They would be the first felled under the rule that dominated and suppressed trees are first removed. Their increment therefore adds little or nothing to the standing volume during the period. If, however, these 8″—12″ trees are already a regular even-aged crop they would presumably not be felled at all under the rule "there is no hard and fast rule regarding what is overwood. Complete uniformity is not aimed at, and all that is desired is a homogenous crop of seedlings, saplings, or poles arranged in groups of sufficient size." In the latter case *neither their increment nor their standing volume would be available for felling. Yet of all the increment added during the period this 8″—12″ class provides almost exactly one-half!!*

Analyse a little further. The standing volume is put at 11,945,775 c.ft. This gives a yearly yield, with a 30-year period, of 398,192 cubic feet. *Yet the prescription is 600,000 yearly, 200,000 c.ft. per annum being added for increment.* If mathematics really can make the South Kheri Periodic Block I—admittedly III Quality in the plan itself—produce timber at that rate they knock silviculture into a cocked hat.

It is not easy to check any of the calculations in this plan (and the Dehra Dun plan) as the yield table printed in Chapter VI is different from that used in the calculation of the yield (as explained in a footnote). This seems a muddled way of doing things. Surely it would be better either to renew the calculations or else to print the yield table actually used.

The same type of error occurs in the other plans. Figures for regular *young* thinned crops with overhead light are applied to irregular crops. In the Thano Working Circle for instance is a calculation for mean age. The formula, is sound. Where the age figures were obtained we do not know. We are told that the mean age of a 10″ diameter tree at present is 19 year

in Thano. The forest is between II and III Qualities. Even in a regular *young* crop with full overhead light such a sized crop of that quality would be nearer 50 years old and it would be far more in the actual forest crop in Thano. Actually the age taken shows an average annual basal area increment of 4·1 square inches per tree up to 10″ diameter whereas the plots in Thano—not by any means the worst patches—*regular* and *thinned* show, for crops 5 inches up to 15 inches, increments per tree from 1·0 square inches up to about 3·8 square inches per annum and on the average about 2·0 square inches. The yield table printed in the same plan shows regular crops of this size and quality to be rather over 50 years old. The age calculated of 32·4 years (apparently quite forgetting the establishment period) is too small giving a yield far too large.

North Kheri is just the same. Para. 117 fixes a rotation of 90 years including establishment, whereas the table shows 90 *excluding* establishment, and then in calculating the yield in para. 118, the rotation is further reduced to 80 years—all this increasing the yield.

We make no comment on the adoption of the exact culmination point of mean annual increment shown by the first yield table published as a policy of management, but even on the figures these yields are all too high. Nor is this mere quibble. In the example quoted for South Kheri the yield should be reduced some 15 to 20 per cent. at once and Dehra Dun as much. We know this is to be done in South Kheri.

These excessive fellings are bound to lead to difficulties in ten years time. Surely it is better to go a little slow to begin with knowing that the Circle is an establishhed fact and that there is to be a revision in ten years when matters need not be so rushed.

To an outside reader it appears as if various formulæ (there are *four* different ones in the paragraphs criticised) had been picked out from text-books and figures substituted without any real understanding of either the formulæ or the figures.

Most of our space has been used but we feel that attention must be drawn to this drastic reduction of rotations in

sal, for that is really what excessive felling comes to, if continued. There may be many good reasons for such drastic reductions but these plans do not give them—they lead one to suppose that the figures justify the yields.

So far as silviculture and organisation go the plans are refreshing reading. There is nothing very new silviculturally—the general tendency being to convert to more uniform methods—but they do recognise and emphasise that silviculture is a matter of specific knowledge and study and they are definite in what they want. The recognition that protection forest with no fixed exploitable girth is *not* a happy hunting ground for the revenue fiend, that exhausted forest whatever the cause needs rest and cannot go on supporting fellings, that regeneration is even more important than revenue are all excellent maxims and the branch seems to have made up its mind that it will insist on good silviculture.

The silvicultural systems, naturally, do not vary much from the usual text-book methods, but there are a good many interesting details which space forbids us to comment on. While there are many points which will not be universally agreed to the silvicultural principles of these plans is, broadly speaking, excellent and refreshing.

The control of the plans is clear and good and is an improvement on anything which has so far come to our notice. Details might again be criticised (though the details are in a separate publication) but it would be ungracious to do so when the more important matters are so well tackled.

May we hope that it is not too late to alter the yield prescriptions? With the careful enumerations now made by the Circle, the rotation of revision of plans, and the improved control, really excellent increment figures will be available at the next revision and earlier if a party is sent to re-enumerate. Surely it would be better to prescribe a cautious figure—even omitting increment if necessary—for this first short period. Except for this the plans as a whole mark a distinct advance.

EXTRACTS.

MEN OF THE TREES.

Wherein is told the remarkable story of the Forest Scouts of Kenya, formerly a band of African Warriors known as Forest Destroyers.

Who are the Men of the Trees, or the Forest Scouts of Kenya, as this body of Africans has now come to be known? They are a band of some thousands of warriors who inhabit the highlands of Kenya Colony, formerly British East Africa. This organisation originated among the Kikuyu tribe, who were locally known as "The Forest Destroyers" by reason of their shifting methods of agriculture. Whenever they wanted to make a fresh cultivation they went into the virgin forest, cut down and burnt off the trees, planted their seeds, and reaped two crops, after which they abandoned the old cultivation and proceeded to take up more land, repeating the same process of destruction until the whole countryside became denuded of trees.

When I first went into this country I pitched my tent on a hill known to the natives as Muguga, which means a treeless place. Here I looked out over a country which at one time had been all virgin forest, but was now bleak and bare. It was a fact that the rainfall had considerably decreased since the disappearance of the high forest, and this was beginning to reflect adversely upon the crops.

It was not a difficult task to convince the chiefs and elders, of the tribe of the importance of tree planting. Many *borazas*, or meetings of the chiefs, were held, and the importance of planting trees in the bare spaces was emphasised; and these wise old men realised that something must be done to remedy the situation.

Too often their womenfolk had to go long distances to fetch, may be, a few sticks with which to cook their food, and they saw that the day was not far away when there would be a wood famine in their land. At the same time they said they were helpless in the matter and unable to undertake the organisation of tree planting

by themselves. It was to the Morans (or young fighting men) that they must look to carry out the work. These Morans lived their care-free lives, their time very much taken up in social engagements and in accumulating a sufficient number of goats with which to purchase their wives. They thought little and cared less of the consequences of a possible wood famine. For their part they did not have to carry the wood and it mattered little to them if their *bibis* (wives) had to go one hour or two days to fetch the sticks, so long as it did not interfere with their dancing. These young warriors seemed to think of little else than attending *n'gomas* (native dances). If the news spread that there was to be a dance, they would come from far and wide to attend ; so it was under the pretext of dancing that on an appointed day three thousand stalwarts of the tribe turned up at my camp.

It was a sight to be remembered. Long before the hour fixed, they started to arrive. On they came in companies, each headed by their captain—first the juniors and finally the older men—their bodies painted in picturesque or fantastic designs and each man carrying his spear and shield, as if prepared for battle. They fell in by ranks, in front of a platform which had been previously erected, and took their orders from their respective captains. When they had all assembled and silence had been called for, I addressed them as follows :—

" Men of the Kikuyu tribe, I have brought you together to-day because a reproach hangs over your tribe. Too long have you been known by the name of Forest Destroyers. In the past, whenever you have wanted to make a new *shamba* (cultivation) you have gone into the forest and cut down the trees. You have done this because it is there, in the forest, that you have found the best soil. Have you ever thought that it is the trees that make the good soil in which you can grow the best crops ? If then you are to go on finding good soil, you will have to plant up the old cultivations with trees, so that when all the virgin forests have gone you will be able to return to the young forests which you yourselves have planted. To-day I am going to call for volunteers, for men among you who will undertake to plant ten trees each year and take care of trees everywhere."

This day fifty volunteers came forward and a badge of membership was tied on their left wrist to remind them of their obligation. No more volunteers were called for, but after the initiation of the first fifty members each candidate had to be proposed by his chief, who had taken the rank of forest guide. Later on the scout ideal was added, to do at least one good deed each day, and a secret sign and password was instituted to safeguard the organisation.

At the initiation the attention of candidates was always drawn to the colours of the Men of the Trees. They are green and white ; green to remind members of their obligation to plant trees, and white because every member's heart must be *safi*, meaning clean. If any member had an unfulfilled obligation he could not be said to have a *safi* heart. At first the " good deed a day idea " was not readily understood by them, and often in the evening thirty or forty members would come to my camp and say, " Great White Chief, we have come to you to ask you to help us to think of a good deed. In two hours the sun will set, and so far we have been unable to think of a good deed." This little difficulty was overcome by starting a forest nursery close by, where members were allowed to plant out fifty young trees, which counted as their good deed. At the same time it was explained to them that this was not necessarily the best kind of good deed ; they must *search their hearts to find other things* to do.

Since these early days candidates have learned to understand the true meaning of the scout ideal, and often little deeds of kindness are done to assist, may be, a neighbour or an old woman. There have also been instances where members have come to the assistance of settlers and refused to accept rewards, as they are Forest Scouts. One day a settler was proceeding to Nairobi with a load of produce in his Ford, and as he approached a particularly muddy stretch of road " Tin Lizzie " came to a standstill and refused to be coaxed on her way. Forest Scouts come to the rescue and pushed the car on to firm ground. When the settler was ready to start off again, he offered *baksheesh* to the leader of the party who had come to his assistance. He was greatly surprised, however, when this boy spoke up for the rest and

said, " Please let us off taking *baksheesh*, as we are Forest Scouts, and what we have done will not count as a good deed if we take a tip. Please let us off and we shall be thankful."

Already they have proved themselves true to their promises in many ways, and to-day there are over three thousand members of the tribe wearing the same badge of membership, having taken the threefold promise, all belonging to the same brotherhood. Where one time tribes were suspicious of each other, to-day they exchange hospitality, for are they not all Forest Scouts? This movement started in so small a way, is rapidly spreading and bids fair to become a power for good among these primitive tribes.

Up till now the Forest Scout method of re-afforestation has only been applied in Kenya Colony, but those in authority are realising that such methods are capable of a very broad application and it may not be long before Forest Scout organisations are formed in other parts of Africa with variations adapted to local needs and conditions.—[*R. St. Barbe Baker* in *American Forests and Forest Life, June* 1924, *pp.* 330—333.]

FORESTS AND RAINFALL.

The question of the influence of woodland upon rainfall is a very old one, yet it cannot be said even now to be fully answered. While there is indisputable evidence from all parts of the globe that the reckless destruction of forest-growth has brought progressive desiccation in its train, it has only comparatively recently come to be realised that the problem is essentially hydrological rather than meteorological. When, indeed, one reflects that a forest is itself primarily an adaptation to rainfall and other climatic conditions, it is somewhat surprising that the earlier investigators should have expected to find anything more than a secondary reaction of the forest upon rainfall. No doubt the characteristic type of forest prevailing in moist regions like Europe helps by maintaining the humidity of the atmosphere to equalise, if not slightly to increase, the rainfall over the year as compared with denuded tracts; but, on the other hand, recent

research by Quayle in Australia (Proc. Roy. Soc. Victoria, Vols. 33 and 34, 1921 and 1922) has shown that where forest and scrub are composed of drought resisting species, reducing transpiration to a minimum, a distinct increase of rainfall has followed deforestation in the interests of settlement and the replacement of xerophilous vegetation by grass and crops.

It is, however, as a hydrological agent that forest plays an immensely important part in conserving moisture in the soil regulating its discharge into rivers, and in generally modifying the natural drainage of a country, though the precise effect must vary with the nature of the country and the climate. It is satisfactory to find that this deeper understanding of what is in reality a very complex problem in physical geography is leading to investigations abroad, as in Italy where, according to Prof. Filippo Eredia, the various hydrological services are studying the relation between rainfall and woodlands in all its aspects ("Boschi e precipitazioni acquei," La Meteorologia pratica N. 1, 1922).

One very important fact bearing upon this subject remains to be pointed out. It was shown by that eminent climatologist, Julius von Hann, that there is a way in which forests do very decidedly increase "rainfall" in the broader sense of the term, namely, by collecting the moisture of fog. This is especially true of hill-fog and mountain mist. Upland fog is, by its different mode of origin, normally wetter than lowland fog, and on drifting across wooded mountain slopes deposits large quantities of moisture. Even in the drier lowland fogs produced by radiation on cold nights it is a familiar fact of observation that there is a constant dripping of water beneath trees, which, when the temperature is below freezing-point, become heavily decked with rime, often collecting on the ground like a light snowfall.

In this connexion, the experiments or Dr. Marloth on Table Mountain in the opening years of this century, and published in the South African Journal of Science and elsewhere, deserve to be more widely known. He showed that the vegetation of the

mountain, as well as rain-gauges fitted with wire-netting collected large quantities of water from the hill-mists produced in the moisture-laden S. E. Trade.—[*Nature, Vol. 113, No. 2840, p. 511.*]

CORRESPONDENCE.

MORIBUND FORESTS OF THE UNITED PROVINCES.

SIR,—Mr. Bailey's observations on the above subject in the *Indian Forester* of last April is of great interest to many of us.

Broadly speaking, the most favourable conditions for *sal* are (i) an equable climate, *i.e.*, avoiding the extremes of temperature, humidity and aridity, (2) moist deep sandy loam with good sub-soil and superficial drainage.

Deviations from these conditions adversely affect the quality of the *sal* and it disappears with extremes.

The present distribution of *sal* in the U. P. roughly follows the outer hills of the Himalayan Range and the submontane tract, known respectively as the *Duns*, *Bhabar*, *Tarai* and plains In the south of the Province and linking up with the Central India belt, natural *sal* forests are still to be found within a few miles of Benares and Mirzapur. I am also credibly informed that small patches of *sal* forest occur in the Gwalior State. I believe that the best *sal* forests in the U. P. are to be found in parts of the North Kheri Division, but that these forests are far inferior in quality to the best quality forests of Bengal and Assam.

Sal is entirely absent from the Gangetic alluvial plain, which passes through the Province, unless one considers the deep alluvial deposits in the valleys of the Northern Vindhyan hills to be part of the Gangetic formation.

There is a very great deal of circumstantial evidence and I believe some historical record that the *sal* forests extended along the main rivers of the Gangetic plain 400 years ago and with the knowledge of the soil changes that have occurred in the interval the entire disappearance of *sal* from this tract is understandable.

It is also obvious to careful observers that the gap between the two U. P. *sal* belts is still widening.

Now for the causes. It is known that, apart from erosion forest clearances may have little or no effect on the local rainfall or humidity, but may appreciably affect more distant regions in the lee of the moisture currents.

The extensive clearance of forests in the Gorakhpur and Bahraich Divisions referred to by Mr. Bailey are but a small portion of the whole to which the present day destruction of the Kumaon and Garhwal forests may be added. The rate at which these hill forests have been destroyed was fittingly indicated in the recent debate on supplies in the Local Council, by a reference to the old man who now had to walk 40 miles for his plough wood, whereas in his youth he could obtain it in his village. The sum total of all these clearances, as Mr. Bailey says, is to change the natural conditions of the country. One of the many deteriorating effects is to reduce the *humidity* to a point favourable to frost damage and hence areas previously free may now be affected.

I believe that the chief cause of unsound timber in the Kalagarh Division can be traced to frost damage and that the damage is far greater than is appreciated, I give some figures.

	Diameter classes				Remarks.
	1′ to 1′-4″.	1′-4″ to 1′-8.″	1′-8″ to 2′.	over 2′.	
No. of trees noted.	5,112	4,183	5,455	5,115	In addition to these figures it is estimated that at least 20 per cent. of the other trees were partly unsound.
No. of trees found to be totaly unsound.	1,841	1,591	1,562	1,448	

It has been said that most of this damage in Kalagarh was caused by the exceptional frost of 1905; this may be so, but nevertheless frost every year kills back a large amount of regeneration. I believe this to be the main cause of regeneration

difficulty in Kalagarh; exceptional years and favourable for regeneration may occur, but these are admittedly at rare intervals.

It may be possible to introduce palliative treatment in the case of *sal* forests now affected by frost but in those *sal* forests where the changed conditions have affected the sub-soil and superficial drainage there is nothing to be done but to accept the inevitable.

I recently inspected some Kalagarh *sal* timber believed to have been sawn 70 years ago, some of the timber was quite sound still and all was of sizes which it would be almost impossible to obtain to-day in a sound condition: I mention this as possibly indicating that the humidity was greater in those days and frost consequently not so severe.

It would be interesting to know whether the effect of the altered climatic conditions, apart from changes in drainage, is more marked in the west than in the east of the Province as this would be understandable.

It will be readily agreed that a very great problem exists in those areas where frost damage is accentuated by the increased aridity of the atmosphere. To mitigate forest damage it is necessary to keep the air in circulation; this might be effected by keeping the crop open, avoiding undergrowth and possibly clearing air circulation channels in the direction of the slope. It has often occurred to me that any regeneration success from strip fellings and opening out the canopy is due largely to the improved air circulation.

The effects of the changed climatic conditions on the *sal* forests are so varied that any uniform treatment is quite out of the question: for instance the strip regeneration fellings, although they might be beneficial in Saharanpur would probably have no advantage in Gorakhpur.

Whatever treatment is prescribed it can only be considered as palliative measures prolonging the ebbing life of the Moribund *sal* forests in the U. P. What may eventually happen to the United Provinces is a matter for very earnest consideration.

Kalagarh,
U. P.

E. BENSKIN, I.F.S.

ELEPHANT CAPTURING WITHOUT DECOYS.

SIR,—I have just read an article written by a Forest Inspector in the May issue of the *Indian Forester* regarding elephant capturing without decoy elephants.

There is no novelty in the method adopted by Mr. Pestonji D. Patel. Everywhere in North Malabar the jemnies who could not afford to have good decoys have been adopting the same method for years together.

The method has its own defects and drawbacks. Casualties among such captures are very many owing to insanitary conditions and surroundings. The ground can never be made hard enough to prevent urine from soaking in, and if the owner keeps the animal in such a kraal for more than a month he may expect it to die. The system might do well for quite a young calf which can be taken out in a fortnight's time.

T. T. ANSEP,
Range Officer, N. Malabar.

SUGAR-CANE IN TAUNGYAS.

SIR,—I should be glad to hear whether any of your readers have tried sugar-cane as a field-crop in *taungya* or other plantations.

It is under experiment in South Sylhet and in spite of its reputation for soil exhaustion the results up to date are far from bad. It is planted between the lines of trees so that the roots do not make contact and room is left to allow trees to come up between the lines of sugar-cane. This will save the labour of clearing jungle in the second, third and fourth years after planting. The Tipperah *taungya* cutters only cultivate their clearings for one year, and the difficulty is to keep the jungle down in subsequent years.

Sugar-cane has a very shallow root-system and when the cane is harvested the leaves are left on the ground.

It is found that one-year-old teak will keep ahead of sugar-cane till the rains begin, then the sugar-cane overtops the

teak by a foot or two till July after which the teak goes ahead and regains supremacy.

Sugar-cane is a very popular crop on the hill sides in the Sylhet district. The writer has noticed that Giant Ageratum (*Eupatorium*), a luxuriant form of undergrowth which springs up on any waste land, grows with apparent feebleness for the first two years on abandoned sugar-cane fields but regains its usual vigour latter.

It is hoped that with the help of the cane the young plantation will get a really good start of the undergrowth, which owing to the warm moist climate of these parts ordinarily grows with such rapidity and vigour as to make annual clearings appear an almost hopeless task with the small amount of labour available

Plantations of mixed teak and *gambar* show the best results up to date, the rapid growth of the latter preventing dichotomy in the teak saplings.

F. TRAFFORD, I.F.S.,

Conservator of Forests, Assam.

THE REVISED WORKING PLAN FOR THE GALI FORESTS OF HAZARA.

SIR,—There are two very interesting points raised in Mr. Greswell's Revised Working Plan for the Gali Forests of Hazara regarding the treatment of *kail* (*Pinus excelsa*) on which perhaps experience in Kulu can throw some light.

The first point is in connection with grazing and its effect on regeneration (para. 85). Now, I happen to have been asked to write an article on the regeneration of *kail* for *Empire Forestry* and I have been studying the matter very carefully. The result of my study is that the article will not materialise, as we are not by any means in a position to say yet how *kail* can be made to regenerate. My own conclusion coincides with that of Mr. Greswell, that grazing is a necessity, but this is not yet proved.

At the present moment there are a large number of *kail* areas in Kulu, mixed or pure, in P.B.I., which have been closed for

10 years or more. Seeding Fellings have been made, felling débris collected and burnt, bushes cut, and sowings, generally of deodar, made. These sowings have as a rule succeeded. But, however many *kail* there may be in the overwood, the regeneration of this species, which I have frequently heard "will regenerate like a weed" has not followed at all or only to quite an insufficient extent.

In numbers of cases we have now on the ground just exactly what the sowings gave us and no more. The Pulga block is an excellent instance. Here you have forests running from 7,000′ to 9,500′, beginning with almost pure deodar, passing through a mixture of deodar, *kail*, spruce and silver fir, and ending with pure *kail*, pure fir or mixture of the two. The soil is first rate, the aspect North to North-East. Deodar has been successfully propagated by patch sowings from 8,000′ downwards, and silver fir is spreading naturally in most parts from 7,500′ upwards. *Kail* has been sown with great success from 8,000′ upwards in Nakas, C. 1, but *kail* sowings made some years after the areas were first cleared of rubbish have failed completely, and natural regeneration is only coming on very slowly indeed. Yet on the Sawagani Maidan at the top of the block (there is a photograph opposite page 38 in the revised Kulu Working Plan) *kail* is regenerating excellently. And the Sawagani Maidan is the only part of the block which is open to grazing. Take another instance, a little lower down the Parbatti Valley. In Shataligarh, C. 11, there is a deodar plantation, begun in 1909, the deodar being introduced under an open canopy of *kail*. The area has been kept closed and there is no *kail* regeneration worth speaking of. Yet in the same compartment, some little way to the East in the only jungle available for the grazing of the local cattle (including sheep and goats) an old snowbreak of about 15 acres is completely afforested with young *kail* from 5 to 12 years old. I think these instances justify Mr. Greswell's suggestions, and I have already opened some compartments to grazing (not of sheep and goats) to see if it has any effect. The grass and bushes after 6—10 years closure are now so thick that we are not likely to get results for some time, but I hope that 18 months will do it.

It may not be advisable to leave a regeneration area open from the beginning; that will depend on the state of the soil, whether it has been heavily grazed in the past or not. Closure for a year or two may be necessary to give the soil a chance to recover. That is a question which can only be assured in the light of further experiment. But there is a strong *primâ facie* case for believing that continuous closure will not give adequate regeneration.

The other point is raised in para. 86, in which Mr. Greswell discusses the treatment of silver fir in the Pine Working Circle. Mr. Greswell first of all proposes to replace fir with *kail* "in pure fir areas.....on cool aspects ....either naturally or artificially." I do not know the Gali forests, but if the cool fir aspects are the typical moist aspects in which fir delights in Kulu, Mr. Greswell's *kail* in such places will cost him Rs. 50 a tree by the time they are 5 years old and there will not be more than one or two per acre. I would refer Mr. Greswell to the many sage remarks made by Mr. Trevor in the Kulu Working Plan on the subject of suiting the species to the locality.

But Mr. Greswell goes further and suggests cutting out fir in favour of *kail* where the two occur naturally in mixture. Mr. Greswell obviously does not realise his blessings. In para. 28 he has already drawn attention to the persistance of the branches of the *kail*, which has a serious effect on the value of the timbers. And anyone who has ever had anything to do with *kail* knows that pure *kail* practically never loses its branches. Mixtures of *kail* and deodar give a rather better quality of timber and of *kail* and spruce perhaps better still. But if you want really clean *kail* timber the one mixture that will give it is *kail* and silver fir. The Pulga Block again is a good example of this, but the best example by far that I have seen is to be found in Tos Nal, C. VII (metioned in para. 74 of the Kulu Working Plan), which contains an even mixture, now mature, of these two species. I shall not forget the sight which met me at a turn of the path, a *kail* about 120′ high, absolutely straight, absolutely cylindrical and without a vestige of a branch for 60′, and only one branch

in the next twenty. I found it was not the only one of its kind by any means, but I have never seen its like anywhere else in Kulu.

No, my advice is, stick to all the fir you can and get it up in mixture with, and as an undergrowth to, the pine wherever you possibly can. My ideal in Pulga would be, where deodar will not grow, about 50% of *kail* with 20% spruce and 30% fir in the canopy and suppressed fir under the pine wherever the latter tends to be pure. At the end of the rotation the pine will be really worth exploiting.

O. H. WALTERS, I.F.S.,
Kulu.

THE NORMAL *SAL* SELECTION FOREST.

SIR,—In your July number you reprinted an article from *Empire Forestry* entitled "A Review of Indian Forest Management." On page 388 appear the words....."The North Kheri Division of Oudh is still under a transitional selection system and here selection has been elaborated so far as to provide a graph of the age classes of the actual growing stock in every compartment *with the normal selection forests*".....the italics are mine.

As it happens to be my work to collect figures for normal forests, I cannot let this statement pass without saying that, so far as this office is concerned, there are no figures issued for the growing stock of a normal *sal* selection forest. If they exist I should like a copy of them—so far as I know they are not known even approximately.

I hope I shall not be referred to an article which appeared in the *Indian Forester* of February 1923 entitled "Distribution of Age and Diameter Classes in a Normal Selection Forest." I do not propose to answer that article except as follows. Even if it is assumed that the actual basic figures are correct, all it does is to attempt to work out from a yield table for even-aged forest the normal growing stock of an even-aged forest for a rotation of 80 years and an area of one acre. It then *assumes*

that the diameter class distribution of a selection forest is the same as that of a uniform forest and having *assumed* it proclaims the numbers as those of a normal *sal* selection forest. If anyone likes to believe it they can, but a statement is not proof. What proof there is shows that a normal selection forest under a given rotation is *not* the same as a normal uniform forest for the same species under the same rotation.

S. H. HOWARD, I.F.S.

FIELD CROPS IN TAUNGYAS.

SIR,—I have no intention of being drawn into a discussion of the merits of research into this subject in India, for the simple reason that I know nothing of the conditions there, but Mr. Wood's letter in your issue for July seems to call for a reply. Anyone reading the letter would be led to the conclusion that I had suggested that experiments with different field crops should not be made *anywhere at all.* As a matter of fact, I expressly ruled out from my remarks all such areas as those described by Mr. Wood "*.. .....a railway line runs through the coupes, the surrounding population is very dense... ....*"

Consequently, I object to being used as a sort of whipping-post on which to hang an account of successes in Gorakhpur. Facetious alliteration is no doubt useful in its way, but fairness to other correspondents will in the end cut more ice. Apart from all this we have Mr. Wood's word for the fact that splendid results have been attained "by various wheezes of this nature." Why then ask supposed unbelievers for enlightenment ?

Is not Mr. Wood's geography a little bit shaky? There is a rumour current here that in one place Burma actually joins "India's Coral Strand."

Of course Forest Officers here have been for years aware that in certain circles Burma is regarded as either non-existent or negligible so far as research and scientific forestry go. Hence I oppose Mr. Wood's suggestion that we ought to set to and find out something with teak and field crops, which will help him with his *sal.* If he will kindly refer to the Burma Silvicultural

and Annual Reports for the last few years—paying special attention to the Appendices which give the acreage and cost of concentrated regeneration—he will find that not only have our D. F. Os. and Research Officers been doing something, but that Burma *is* on the map; very much so in fact.

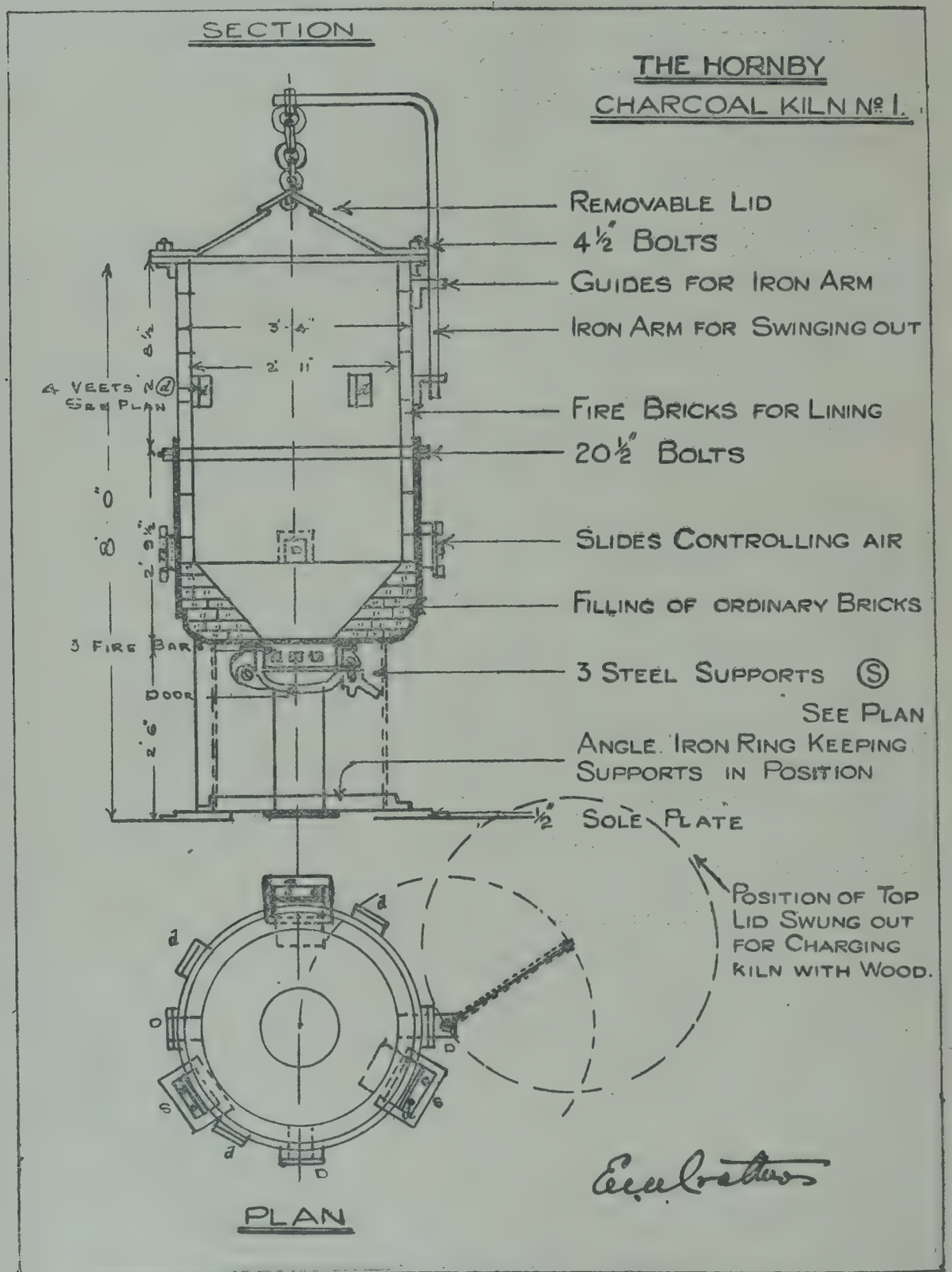
R. UNWIN, I.F.S.,
Rangoon.

DOMESTIC OCCURRENCES.

BIRTHS.

Trotter.—At Mussoorie, on the 26th July 1924 to the wife of Capt. H. Trotter, I.F.S., a son.

Wood.—At Naini Tal, on the 27th July 1924 to the wife of B. R. Wood, I.F.S, a son.


SECTION
THE HORNBY
CHARCOAL KILN No. I.
REMOVABLE LID
4½" BOLTS
GUIDES FOR IRON ARM
IRON ARM FOR SWINGING OUT
FIRE BRICKS FOR LINING
20½" BOLTS
SLIDES CONTROLLING AIR
FILLING OF ORDINARY BRICKS
3 STEEL SUPPORTS (S) SEE PLAN
ANGLE IRON RING KEEPING SUPPORTS IN POSITION
½" SOLE PLATE
POSITION OF TOP LID SWUNG OUT FOR CHARGING KILN WITH WOOD.
4 VEETS (d) SEE PLAN
3 FIRE BAR
DOOR
3'-4"
2'-11"
PLAN

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THE WORKING OF THE HORNBY CHARCOAL KILN.

The following description and notes on the working of the Hornby Charcoal Kiln may be of interest to the readers of the *Indian Forester*. The Kiln is made of steel throughout ; it consists of a cylindrical portion (Kiln proper) in two sections, flanged to bolt together accurately ; the lower section is provided with 3 steel supports, which can be removed when moving the Kiln from one situation to another. The upper section is fitted with a lid, which can be swung out at will (see plan and section). At the bottom of the lower section of the Kiln there is a grate consisting of 3 fire-bars removable at will. Both sections of the Kiln are provided with vents, which can be opened and closed as required during the process of manufacturing charcoal.

Situation for a Kiln.—The Kiln should be situated in the most sheltered position available, the idea being that the air should be drawn in and not blown into the Kiln as the former is the easier to regulate. I have found it convenient to have a light bamboo screen placed on the windward side of the Kiln to protect it from a direct draught of air.

Erection.—After putting the kiln in position as indicated in the sectional drawing appended, the next step is to build the cone of ordinary brick and mortar in the lower section of the kiln, taking care not to cover any portion of the grate. Above this construction, the lining of fire-bricks is put in, care being taken not to brick up the vents. What is necessary is to form straight arches over these vents. The fire-brick lining is done as follows :—Mix the fire-clay with water in a bucket till it attains the consistency of cream. Dip the bricks in this mixture, turn

them about till well coated, withdraw, drain off drippings, and lay the bricks in position as in ordinary brick-work. It is very essential to have joints between bricks as fine as possible, as otherwise there is a danger of the fire getting through the plaster, at the joints and burning the steel sides of the Kiln. As soon as the brick work has set hard the Kiln is ready for work.

Charging the Kiln.—Swing off the top cover to one side, open the bottom door of the grate, and slide open the draught vents to the full extent. Then begin the filling by placing some combustible material on the fire bars to facilitate lighting the Kiln. I have found chips of wood sprinkled with a little kerosene oil serve this purpose very well.

Above this should be placed a layer of twigs to a depth of 2 to 3 feet; this layer also assists in facilitating the lighting of the Kiln and serves as a cushion for the heavier wood, which will be packed in over it. The instructions received with the Kiln lay down, that wood cut into 1 ft. lengths may be slung on in bundles, one across another, but I have found by experiment that packing the billets by hand in a vertical position, as is done in the case of the paraboloidal over-ground Kiln gives much the best results. The packing is continued in tiers till the Kiln is filled to the top. It is now ready to be lighted.

Firing.—Light the combustible material on the firebars at the bottom of the Kiln, then partially close the bottom door leaving it about one or two inches ajar. Leave all the vents as well as the top cover open fully, until the fire is well started, and is flaming fairly freely, which usually takes about 10 to 15 minutes. The bottom door can be left open till the flame shows itself at the bottom row of vents. Then close the bottom door, put on and bolt the top cover. Any additional air required subsequently to keep the fire going,—if damp or green—fuel is used, may be obtained by removing one or more bars from the grate.

Burning.—When through the lower vents the wood is seen to be glowing a dull red, these vents should be partially closed, and left in that condition till the fire shows at the row of vents above; then close the lower vents almost completely,—that is, leave them open to an extent of $\frac{1}{8}$ of an inch.

After about 3 hours from the time the Kiln was lighted, the bottom row of vents must be closed completely. When once closed they should not be opened again or the charcoal below these vents will be reduced to ashes. The burning should be continued till it is necessary to completely close the upper row of vents. This will be about 6 hours from the time when the Kiln was lighted. The instructions with the Kiln describe a process of adding fuel whilst the burning continues, which is termed "topping off," but I have found that in doing so the quality of the charcoal is somewhat inferior to that produced without adding fuel during the burning process.

Closing up the Kiln.—When the flame has reached above the top row of vents, the cover should be screwed down as tightly as possible. If any leakage of smoke occurs anywhere around the lid or at the vents, a little fire-clay, mixed with water to the consistency of cream, should be applied to stop the leakage. In this condition the Kiln should be left for the night.

Drawing off the charcoal.—The charcoal can be withdrawn by opening the door at the bottom and removing the firebars All other vents and the lid should be kept closed. If the Kiln has been kept properly sealed up, no glowing bits of charcoal will be found, but if any leakage has occurred a few pieces here and there may be found alight, which should be sprinkled with water as soon as detected. It will have been noticed that the management of the Kiln is very similar to that of the paraboloidal over-ground Kiln. The vents in this case can be closed rather more easily than in that of the paraboloidal over-ground Kiln.

Labour required for a Kiln.—Four men can fill the Kiln in $\frac{3}{4}$ of an hour. One man can manage the Kiln without assistance. The Kiln if lighted at 8 o'clock in the morning may be closed up by 6 o'clock that evening. The charcoal can be drawn off, and the next charge put into the Kiln immediately.

Size of billets.—For a Kiln of the size described in these notes, billets up to 6″ diameter may be used, the best size being 4″ in diameter and 12″ long.

Patching the fire-proof lining.—After a charge has been drawn off and before refilling the Kiln, it should be carefully examined for cracks. These need patching up before the Kiln is used again. Patching is done as follows:—Ordinary clay should be mixed with water to the consistency of treacle; with this mixture wash over the area to be patched; over this apply fire-clay mixed with water to the consistency of paste, using it like ordinary plaster in brick-work. The thickness of a patch must not exceed 2 inches. A thicker patch is liable to crack as it dries and to fall off.

Statistics.—Below is given the results of 14 charges of the Kiln. Soft wood and hard were mixed in most cases. Two charges of hardwood used pure are given (*Acacia Sundra*) for comparison with the results of mixed hard and soft woods. The lowest percentage by weight to the fuel used is 23 and highest 35.

With an over-ground paraboloidal Kiln as described in Prof. Troup's *Manual of Utilisation* the best results obtained with a species like *A. Sundra* were 20 per cent. The charcoal was weighed and measured immediately on being drawn from the Kiln in all cases. The cost of producing a ton of charcoal including the value of the fuel used amounts to Rs. 30, the cooly-wage in the locality being Re. 0-6-0 per day per man. The quality of the charcoal is very good, being much better than it is possible to produce in any form of temporary over-or under-ground Kiln. The Kiln described above was purchased from Messrs. Massey and Co, Engineers, Madras, F.O.R., Kurnool, for Rs. 950. With the Kiln, enough fire-bricks and fire-clay are supplied to keep the Kiln going for some time. These Kilns can be obtained in larger sizes than the one depicted in the drawing, but the question of portability comes in. A No. 1 size Kiln weighs a ton and can be carried by 2 carts quite easily, a larger Kiln may not be so easily portable. A section of it may weigh a ton, and no ordinary bullock cart could deal with such a load.

E. M. CROTHERS, I.F.S.,
District Forest Officer,
Kurnool West.

STATISTICS RELATING TO THE MANUFAC

Serial number of charge.	Date and hour of firing the Kiln	Date and hour of closing the Kiln.	Date and hour of drawing the charcoal.	Kind of fuel used.	Age of fuel used.
1	2	3	4	5	6
1	3rd February 1922, 12 noon.	3rd February 1922, 7 P.M.	4th February 1922, 8 A.M.	⅓ Poliki ... ⅓ Battaganupu. ⅓ Billudu	11 months...
2	4th February 1922, 12 ncon.	4th February 1922, 6 P.M.	5th February 1922, 8 A.M.	½ Billudu ... ½ Battaganupu.	Do. ...
3	5th February 1922, 10 A.M.	5th February 1922, 6 P.M.	6th February 1922, 7 A.M.	⅓ Poliki ... ⅓ Billudu. ⅓ Korivi.	Do. ...
4	6th February 1922, 11 A.M.	6th February 1922, 7 P.M.	7th February 1922, 7 A.M.	⅓ Tandra ... ⅓ Battaganupu. ⅓ Musti.	Do. ...
5	7th February 1922, 11 A.M.	7th February 1922, 6 P.M.	8th February 1922, 7 A.M.	¼ Tandra ... ¼ Chinta. ¼ Battaganupu. ¼ Tandra.	Do. ...
6	8th February 1922, 11 A.M.	8th February 1922, 6 P M.	9th February 1922, 7 A M.	⅓ Poliki ... ⅓ Billudu. ⅓ Tandra.	Do. ...
7	9th February 1922, 11 A.M.	9th February 1922 6 P.M	10th February 1922, 7 A.M.	Tandra ...	Do. ...
8	14th February 1922, 12 noon.	14th February 1922, 7 P M	15th February 1922, 7 P M.	¼ Tandra ... ¼ Velaga. ¼ Sundra. ¼ Billudu.	Do. ...

TURE OF CHARCOAL BY A HORNBY KILN.

Quantity of fuel charged in the Kiln.		Quantity of charcoal obtained.		Quantity of charcoal obtained in each Kiln.	Percentage of charcoal obtained in weight.	Botanical names of species mentioned in Col. 5.
By volume in c.ft.	By weight in lb.	By volume in c ft.	By weight in lb.			
7	8	9	10	11	12	13
33	728	14	168	Good ...	23·08	Poliki—*Givotia rottleriformis*, Griff.
32	840	14	224	Fair ...	26·66	Battaganupu.—*Adina cordifolia*, Hook.
34	616	14	171	Do. ...	27·76	Billudu—*Chloroxylon Swietenia*, D C.
33	812	14	223	Do. ...	27·46	Korivi—*Ixora parviflora*, Vahl.
33	840	13	231	Do. ...	27·50	Tandra—*Terminalia beterica*, Roxb
						Musti—*Strychnos Nux-Vomica*, Linn.
						Velaga—*Feronia Elephantum*, Corr.
						Sundra—*Acacia Sundra*, D C.
31	784	12	154	Good ...	19 64	Gumpani—*Odina Wodier*, Roxb.
33	868	14	210	Fair ...	24·19	Chillareni—*Albizzia amara*, Boiv.
32	784	12	231	Good ...	29·46	

STATISTICS RELATING TO THE MANUFAC-

Serial Number of charge.	Date and hour of firing the Kiln.	Date and hour of closing the Kiln.	Date and hour of drawing the charcoal.	Kind of fuel used.	Age of fuel used.
1	2	3	4	5	6
9	15th February 1922, 10 A.M.	15th February 1922, 6 P.M.	16th February 1922, 7 A.M.	¼ Velaga ... ¼ Tandra. ¼ Chikareni ¼ Billudu.	11 Months.
10	16th February 1922, 9 A.M.	16th February 1922, 7 P.M.	17th February 1922, 7 A.M.	¼ Velaga ... ¼ Tandra. ¼ Gumpani. ¼ Billudu	Do ...
11	17th February 1922, 10 A.M.	17th February 1922, 6 P.M.	18th February 1922, 7 A.M.	¼ Billudu ... ¼ Billudu. ¼ Korivi. ¼ Velaga.	Do. ...
12	18th February 1922, 9 A.M.	18th February 1922, 6 P.M.	19th February 1922, 7 A.M	⅓ Velaga ... ⅓ Billudu. ⅓ Tandra.	Do ...
13	1st March 1922, 8 A.M.	1st March 1922, 6 P.M.	2nd March 1922, 8 A.M.	Sundra ...	Do. ...
14	2nd March 1922, 9-45 A.M.	2nd March 1922 6 P.M.	3rd March 1922, 7 A.M.	Do. ...	Do. ...

TURE OF CHARCOAL BY A HORNBY KILN.

Quantity of fuel charged in the Kiln.		Quantity of charcoal obtained.		Quantity of charcoal obtained in each Kiln.	Percentage of charcoal obtained in weight.	Botanical names of species mentioned in column 5.
By volume in c.ft.	By weight in lb.	By volume in c ft.	By weight in lb.			
7	8	9	10	11	12	13
30	896	14	266	Good ...	29·69	Poliki—*Givotia rottleriformis*, Griff.
						Battaganupu—*Adina cordifolia*, Hook.
34	924	14	266	Do. ...	28·78	Billudu—*Chloroxylon Swietenia*, D. C.
						Korivi—*Ixora parviflora*, Vahl.
36	840	15	259	Do. ...	30 83	Tandra—*Terminalia belerica*, Roxb.
						Musti—*Strychnos Nux-Vomica*, Linn.
30	896	14	259	Do. ...	28·90	Velega—*Feronia Elephantum*, Corr.
						Sundra—*Acacia Sundra*, D. C.
32	1,120	23	401	Do. ...	35·62	Gumpani—*Odina Wodier*, Roxb.
30	1,036	21	350	Do. ...	33·78	Chillareni—*Albizzia amara*, Boiv.

REGENERATION FELLINGS IN THEORY AND PRACTICE.

It is a commonplace that theory and practice may differ widely. In Forestry, and not least in its creative branch silviculture, this is particularly true. It is thus that each country tends gradually to develop its own technique for the regeneration of woods, and in the case of two European nations, close proximity, and no great difference of locality conditions, have not prevented extremes in silvicultural practice. France has long been the exponent of natural regeneration, Germany of artificial reproduction: the one has pinned her faith largely on the seed-tree, the other has relied mainly on dibble, hoe and spade. In Germany, indeed, rigidity in applying silvicultural systems has become proverbial. No other country has upheld their identity and distinctiveness so effectively and enthusiastically. Of these systems, those producing regular crops—and this excludes only the selection—are five in number :—

(I) SHELTERWOOD.—A large area is treated at one time and a series of cuttings or "successive regeneration fellings" is made so as gradually to admit light to the seedlings. The fellings comprise preparatory (where necessary), seeding, intermediate and final cuts, their number and severity depending on the rate of establishment and upon the early growth of the reproduction.

(II) SHELTERWOOD GROUP.—A modification of the above whereby valuable advance growth, if present, forms the nucleus of concentrically arranged cuttings. The groups thus eventually merge into each other and regeneration is completed.

(III) STRIP—(*a*) *Narrow Strip*.—Commencing from the leeward side, narrow strips in a stand are clear felled and seed is blown in from the adjoining trees. After regeneration is secured, an additional strip is felled, and so on.

(*b*) *Progressive Strip*.—Another modification of the shelterwood method. Successive regeneration fellings are made over narrow strips, at such intervals of time that reproduction is proceeding in three strips simultaneously, one being at the removal (final and intermediate) stage, one at the seeding and one at the preparatory.

(*c*) *Wagner's Progressive Strip.*—The stand is divided into a number of felling series of moderate depth, and cuttings proceed from N. to S. irrespective of wind, configuration, etc. The three zones of (*b*), though present, cannot be clearly distinguished, as they are cramped together on a strip some 50 yds. deep. There is thus a definite increase in the density of the crop—and therefore of shade—from N. to S. on the strip. Progress is very slow: on an average only 2—3 yds. are added annually to the depth of the step. Moreover final fellings are very conservative and are not made until some years after the regeneration is established. In this way the whole felling series is finally regenerated.

(IV) PHILLIP'S WEDGE.—This system was evolved by Eberhard but has not been adhered to by him. Phillip has modified it as follows:—

Compartments to be regenerated are divided into strips 90 yards broad by extraction lines. Regeneration is obtained by method (III) (*b*) but advance is on two fronts which form an acute angle or wedge. This wedge, bordered by the extraction lines, advances over the compartment strip; on slopes it must proceed downhill, on the level against the prevailing winds. The idea is to save the young regeneration from damage and ensure a minimum of extraction-labour, especially on steep gradients, al the trees being felled downhill towards the extraction-lines There is also good control over light-intensity and mixtures of species having very different requirements in this respect can readily be obtained.

The systems briefly outlined above have long been the mainstays of natural reproduction in all countries where forestry is worthy of the name. It is perhaps curious that Germany, on whose soil most of them originated, should have applied them with such precision as largely to discount the creative potentialities of Nature. She has thereby accentuated the defects inherent in any system whatever; planting and sowing have come to supplant natural regeneration, not to supplement it. In short the system has too often been, not a means to an end, but an end in itself. And with such a tradition, her recent change in policy is rendered all the more noteworthy and instructive.

Since the war Germany has suffered a revolution in silviculture no less radical than that affecting her political constitution. To foresters it may well seem more momentous. This revolution, like any other, had a definite focus and its effects are still spreading. Of the "classic" systems we have enumerated, practically none are now employed. Wagner's alone is in full and successful operation at Gaildorf (Wurttemberg) and nowhere else. Here indeed, theory and practice scarcely differ. The felling series are some 300 yards deep and the reproduction strip about 50 yards with an average annual addition of 2 yards. Regeneration advances rigidly southwards and with a rotation of 100 years uphill-extraction on north slopes presents no difficulty. The line of demarcation between the old growing stock and the reproduction-strip is clear and absolute and advance growth in the old stands is ruthlessly cut out when encountered. The silver-fir, Scots pine, spruce and beech of these woods regenerate well, the graded light intensity on the reproduction strip ensuring proper conditions for the establishment of each in turn—the silver-fir and beech followed by spruce and Scots pine.

The success of this system at Gaildorf, however, is misleading and only proves its suitability to special locality conditions which it was expressly designed to satisfy. By providing complete sun-protection for an easily desiccated soil, it preserves that sufficiency of moisture necessary for the seedlings: on the other hand regeneration, if sure, is slow, and since the number of felling-series cannot be indefinitely increased, parts of the growing stock suffer from neglect. Again, the numerous felling-series required is a serious drawback to its introduction elsewhere; only an exceptionally constituted growing stock could avoid the trouble and sacrifice entailed.

The other systems, it is affirmed, as means of natural regeneration have failed. Turned suddenly radical, the German Forester has acted up to his convictions with characteristic thoroughness. Thus the shelterwood system, once so prevalent in Prussia, can now only be seen in operation at Salmünster and where much artificial aid is given by burying seed in furrows and scattering evenly those which have fallen naturally. It was

a former boast that as much as 16 cwt. of acorns had been added to the natural stock over a hectare of ground.

Phillip's Wedge system is practised only by Phillip himself, who raises artificially on his "wedges" twice as many seedlings as normal extraction of the old trees would destroy. With his subordinates the system finds no favour, but rather excites ridicule.

The shelterwood-group system, until recently in vogue at Kelheim (Bavaria) has now been abandoned as unworkable. The progressive strip-method (III) (*b*) has been discarded for some time, while the narrow-strip system (III) (*a*) can barely be recognised in a few compartments in the communal forests of Heidelberg; in Bavaria and Saxony it has been degraded into clear-felling and planting.

This wholesale abandonment of well-known systems on the part of an experienced forest personnel is a striking phenomenon. German forestry has reached a phase which may well become historical. The movement apparently had its origin in Wurttemberg and Baden where natural regeneration of silver fir is prolific and possibly indicated the lines which the revolution has subsequently taken. And the greatly enhanced cost of sowing and planting since the war must certainly have precipitated matters.

However that may be, the general dissatisfaction has had a definite result. A new regime, curiously described as "system of organised chaos" has been evolved in the above States. Briefly, all regeneration provided by Nature is taken advantage of and fresh indications of it watched for. Group-fellings extend advance growth and successive regeneration fellings are made here and there and in between (up to the limit of the possibility). As reproduction becomes general, progressive-strip fellings, sometimes in wedge-fashion, are executed to complete it. In other words, the possibilities of the "classic" methods being fully understood, each and all are applied in the regeneration area, as the officer thinks fit, system only obtruding slightly to ensure complete restocking. The German silviculturist is now following Nature instead of superseding her.

It is only natural that such a reversal of long-established silvicultural policy should not find complete acceptance in a country where forestry is so intensively organised, and where partisan feeling is well-developed. But nothing is more striking to the visitor than the universal tendency towards natural regeneration and a more rational silviculture, seen in recent sudden revisions of working plans and the interesting compromises indicative of Teutonic caution and conservatism but also evidence of the reality of the change.

Such a compromise can be found in the State and Communal forests of Freudenstadt (Wurttemberg). Wagner's influence is still apparent here but the old regularity is gone. Progressive strip fellings are carried out simultaneously on two fronts—N. to S. for sun protection, E. to W. against prevailing winds—the whole forming a stepped series. But the significant feature is the extension of advance growth in the old growing stock by group fellings. Yet as much as 20% artificial aid is necessary.

In the Schönmünzach Range of the Black Forest, the "Perforated Saw" type of regeneration is on similar lines, but is more elastic, despite limitations imposed by a rough climate and by the problem of extraction of large logs on steep slopes. Here a light preparatory felling in the old growing stock establishes vigorous groups well in advance of the progressive strips. Regeneration commences in hollows or next storm firm stands, or from the top of leeward slopes, while on N. and S. aspects, as a compromise between climatic safeguards and extraction facility, it is conducted on two fronts—one downhill, the other against the prevailing wind.

As a last example from Wurttemberg, Eberhard in the forest of Langenbrand combines his "wedge" idea with shelterwood and group fellings. A light preparatory felling provides a ground work of silver-fir and a small percentage of spruce. Thereafter no definite system is prescribed. Eberhard attempts here and there to introduce a "wedge" but only the principle and not the shape can be applied. A proportion of Scots Pine and Oak is readily obtained and only 20% of artificial aid is employed,

mainly on "sour" soils inimical even to spruce. The exposing of the mineral soil by making shallow "dishes" ensures almost complete natural regeneration.

Instances from other States could be multiplied indefinitely. In Heidelberg, the communal forests are regenerated with equal elasticity, but the introduction of spruce and other species among the young hardwood crop compels some regularity and renders Heidelberg a special case. It is not in the Odenwald but rather in the Black Forest that the typical Baden method of regeneration is to be found.

The new régime here attains its fullest expression, the regeneration period extending to two-thirds of the rotation and allowing the silviculturist a maximum of freedom. The state forest of Herrenwiess, the adjacent Schifferschaft Stock Company's forest near Raumünzach and the communal forest of Gernsbach are all good examples. Containing the same species—silver fir, spruce, Scots pine, beech and some larch and oak—they all have fertile soil on which the chief species, silver-fir, regenerates prolifically. No seeding felling as such is made, as seedlings of silver fir and some spruce appear everywhere under the stimulus of thinnings in the old stands. At Gernsbach the removal of cankered larch is sufficient. Group fellings extend the advance growth and the foci spread and merge by seeding feelings over a larger or smaller area, exactly as Nature indicates. The possibility is thus extracted anywhere, regeneration being a matter of light control. In these forests the mixture is being sacrificed to get light-increment of the best trees: Eberhard, on the other hand, under the shorter regeneration period characteristic of Wurttemberg, ensures a good mixture. The Baden policy, which produces an almost pure crop of silver fir, cannot however be criticised without intimate local knowledge. The reserved trees put on enormous increment in their free position and are allowed to stand over regeneration until their presence is definitely prejudicial. The nominal rotation is 120 years and the regeneration period 60 years or more. The young trees in a stand do not however, give the appearance of an irregular crop for long. In a few years after the final cut, the more suppressed growth has

put on rapid height increment and with increasing age the canopy becomes quite regular. An even-aged crop is certainly not wanted in localities with such a rough climate.

In conclusion it must be said that, sound as the method is, too much should not be expected from the success attained so far in Germany. Not only is great silvicultural skill necessary, but the applicability of the system depends on—

(*i*) An excellent road system.
(*ii*) Skilled felling and extraction.
(*iii*) A receptive moist and fertile soil.
(*iv*) Suitable species.
(*v*) Properly conducted thinnings, so that the mature trees may develop good seed-bearing crowns.

These conditions are all fulfilled in the Black Forest: moreover the silver fir is peculiarly adapted to requirements for it recovers rapidly from both suppression and injury and has the power of putting on light-increment late in life.

The possibilities of the method are further limited by the difficulty of obtaining uniform mixtures and of perpetuating light-demanding species, unless heavy fellings in patches are made. Again, the increased branching of the reserved trees reduces their value considerably.

There is perhaps nothing startlingly new in the method to the Indian silviculturist, but to the German it is an advance and a great discovery, and his enthusiasm, reflected in current forest literature, is very genuine. Its application in France to oak and beech crops would be of interest; and perhaps it may not stop there.

F. C. FORD ROBERTSON, I.F.S.

THE ECONOMIC IMPORTANCE AND CONTROL OF THE *SAL* HEART-WOOD BORER (*HOPLOCERAMBYX SPINICORNIS*).

In all countries research in forest entomology manages to convey the impression that it produces little that is of direct use to the executive forest officer. The average entomological bul-

letin with its detailed life-cycle studies, its technical descriptions, its records of discarded theories and incidental experiments does not appeal to his taste. It is either rejected or is digested hastily, and the core of practical results remains undetected in the voluminous fruit of the investigation. What the forest officer requires, it has been said, are not life-histories but death-histories ; not suggested remedies but tested remedies. Hence, the question whether theoretical remedies for the control of forest pests should be tried out by the research officer or by the executive officer is bound to remain debatable. The Indian Forest Service is particularly well constituted for the experimental testing of control measures, yet its record in this field is not exemplary. The subject of this article is an account of almost the first case of practical control-operations on a large scale against an insect pest in the forests of India,—the control of *Hopoloceramby x spinicornis*, the large heartwood borer of *sal* in Thano forests near Dehra Dun. It has taken nine years to introduce and carry through a fair trial of the remedial measures devised, and to achieve that important corollary—an estimate of the financial and silvicultural success of the operations. Foresters throughout the *sal* forests of India will be indebted to the forest department of the United Provinces for an effective demonstration of the practical control of their most important timber pest.

In 1916 an epidemic outbreak of the large *sal*-borer was discovered in the *sal* forests of Thano Working Circle, Dehra Dun Division, which stands on a *chaor* or terrace at the base of the Himalayas. The area affected extended over nearly eight square miles of country with 4,883 acres of forest. It is now known that the epidemic had been working up for several years to the degree of severity at which its existence was recognised, and that the predisposing factors were climatic, in particular rainfall above the normal. The beetles attacked the living trees in the rains, July to September, and their larvæ, boring in the sapwood during the remaining months of the year girdled the trees to death. Trees of all sizes and ages were attacked and the distribution of the attack was closely in direct proportion to the constitution of the growing-stock.

The epidemic ran on unchecked for four years and during that period the timber damaged by the borer amounted to nearly a million cubic feet, representing a loss of Rs. 2,68,562, at a depreciation of about 4 annas a cubic foot standing.

The figures below give the actual number of trees sold as insect-attacked, the total volumes, and the average loss per cubic foot in the year of sale.

Loss due to the Sal-Borer, Thano, 1917—1919.

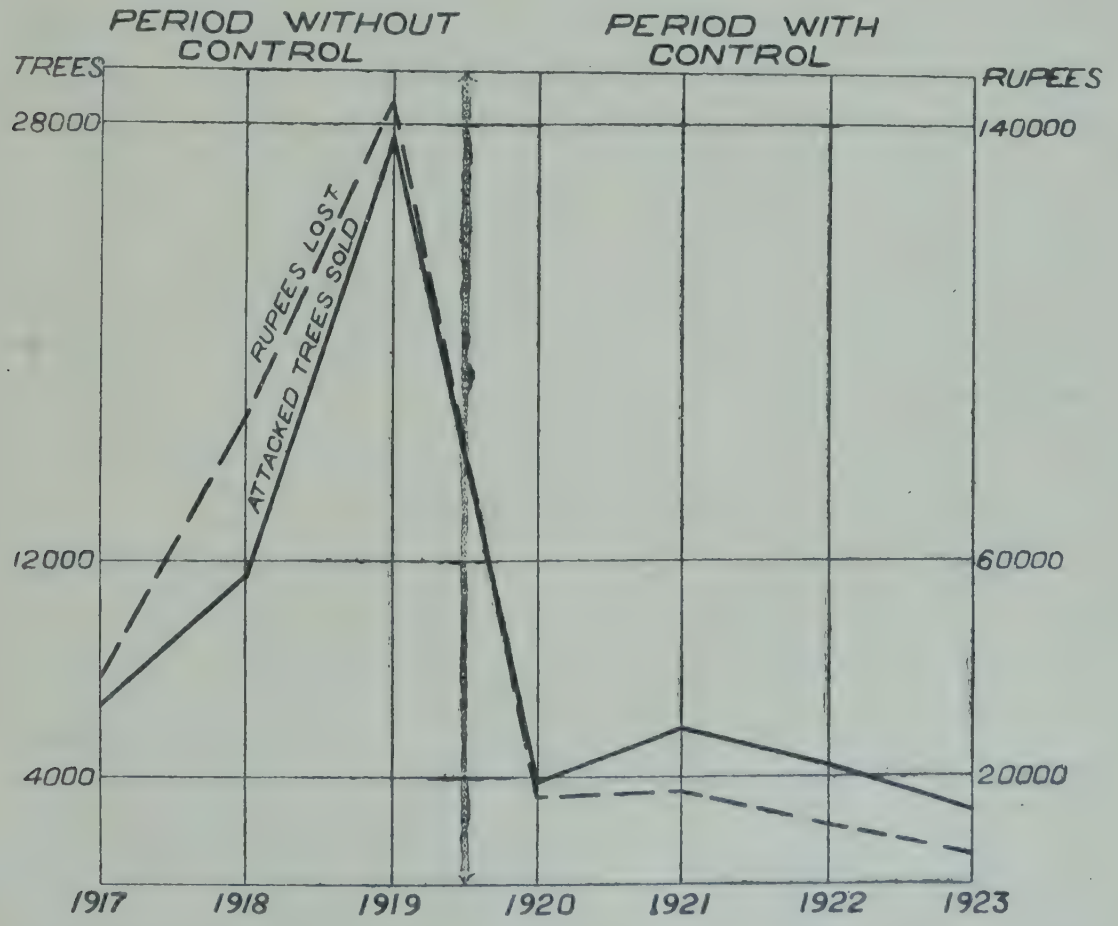
Year of sale.	No. of attacked trees.	Volume of attacked trees.	Average loss per cubic foot.	Total loss.
		Cu. ft.	a. p.	Rs.
1917 ...	6,772	178,955	3 5	38,214
1918 ...	11,336	286,288	4 10	86,483
1919 ...	27,480	502,221	4 7	1,43,865
Total ...	45,588	967,464	...	2,68,562

A loss of over two and a half lakhs was incurred, and the epidemic ran on unchecked until the measures that had been suggested at the outset by the Forest Research Institute were eventually adopted in 1920. The remedy was applied in the season 1920-21 and its controlling action began to operate in the following season, so that from 1921 onwards a real decrease in the abundance of the beetle and the amount of the loss was effected. The figures below give the actual number of trees marked as insect-attacked, their total volumes, the average annual depreciation per cubic foot and the total loss incurred during the period of control work.

Loss due to the Sal-Borer, Thano, 1920—1923.

Year of sale	No. of attacked trees marked.	Volume of attacked trees	Average loss per cubic foot.	Total loss.
		C. ft	a. p.	Rs.
1920 ...	3,855	86,713	3 1	16,710
1921 ...	5,825	83,692	3 4	17,436
1922 ...	4,411	67,402	2 8	11,233
1923 ...	2,625	42,981	2 7	6,939
Total ...	16,716	280 788	...	52,318

During the four years of the period under control measures the average annual loss was reduced from Rs. 89,521 per annum to Rs. 13,079 per annum, and to Rs. 6,939 in the fourth year. This represents an average reduction equivalent to 85 per cent. A graphical comparison of the losses in trees and rupees during the periods with control measures and without is given in the annexed diagram.



Graph showing the number of *sal* trees attached by *Hoplocerambyx* and the loss incurred each year.

The incidence of attack on the growing-stock has been reduced to less than one per cent. in the year 1923 and there is therefore no question that the epidemic has been successfuly fought and is all but stamped out. These results are assigned directly to the action of the remedial measures.

The average human patient, who has taken the medicines prescribed by his doctor and who has been cured of his ills, is content to assign his cure to medical aid. Yet there are some unbelievers who contend they would have got well anyway, if the doctor had *not* been called in. For the benefit of similar sceptics of entomological aid, it is necessary to demonstrate that the remedy has been instrumental in effecting the cure in Thano forest. To this end the normal unchecked course of the epidemic may be regarded in three phases :

(*a*) a steady increase in the numerical abundance of the borer at the same rate as that occurring from 1917—1919;

(*b*) a maintenance of the incidence at the level reached in 1919 ;

(*c*) a steady decrease in the numerial abundance of the borer from the level reached in 1919 to that reached in 1923.

All these phases are within the bounds of probability from natural causes, while a fourth case—the complete and immediate cessation of the epidemic—is improbable on the facts of the incidence in 1923.

In case (*a*) the loss during the latter period would have exceeded thirty lakhs of rupees by 1923 and the forest would have been seriously depleted.

In case (*b*) the total loss for the period would have been Rs. 3,66,200.

In case (*c*) the total loss for the period would have been Rs. 1,66,683.

Hence, under the most unfavourable conditions for control work, that is on the supposition that the outbreak has died out naturally, the amount saved is over one lakh of rupees (Rs. 1,66,683—52,318 = 1,14,365).

Evidence exists to show that in years of rainfall above the normal, the abundance of the borer increases.

The rainfall of the years 1921, 1922 and 1923 has been above the normal in Thano and these years have been favourable for the maintenance of a high and probably increasing incidence. Maps have been prepared showing the distribution of the attack and its intensity from year to year, and these maps clearly show an extension of the borer-infested territory from 1920 to 1922. The figures below illustrate the foregoing statements :—

Comparison of Borer-Territory and Rainfall, Thano.

Year	1920.	1921.	1922.	1923.
Area with infestation of 1 tree per 2 acres.	2,180	2,818	3,630	2,075
Area with infestation of 1 tree or more per 1 acre	1,334	1,652	1,350	734
Rainfall in inches	78·49	116·96	121·34	84·92

Hence it is concluded that the epidemic was on the increase from 1920 onwards, and the general incidence of attack in the previously lightly attacked areas was rising to the level of one tree per two acres, in spite of the fact that the remedial measures were reducing the total attack in the heaviest centres.

The loss prevented by the control operations is estimated at a sum between one and three lakhs of rupees. It is a net profit, as the operations were carried out by timber purchasers at no extra cost to the Local Government (beyond the usual enumeration costs) ; to this sum should also be added Rs. 12,780 the revenue realised by the sale of the attacked timber.

On a very much smaller scale similar operations against *Hoplocerambyx spinicornis* were carried out in Nagsidh forest of the same division. In 1921 from the attacked area 785 *sal* trees were removed ; on the timber of these trees a depreciation of Rs. 2,928 was incurred. By 1923 this area of infestation had been cleaned up and only two attacked trees were discovered.

Dehra Dun division is not the only locality in India where damage by *Hoplocerambyx* occurs on a large scale. The extent to which trees are killed and timber is affected is very imperfectly recognised and is rarely regarded as of sufficient importance to

require special action. As an off-hand estimate of the quantity of dry *sal* wood in his annual coupes the Divisional Forest Officer would probably incline to 5 per cent. Yet a careful scrutiny of the yields of any connected series of fellings, or of the figures for the total outturn of *sal* timber of a Province (in which dry and green timber is discriminated) would show that 20 to 30 per cent. is a more normal figure for the outturn of dry *sal*. Fourteen years ago 3,000,000 cubic feet or 47 per cent. of the total outturn of *sal* from Government forests was classed as dry. At the present time records of dry timber are maintained in only a few provinces and private forests. On actuals the *sal* forests of Buxa, Jalpaiguri and Kurseong vary between 30 and 38 per cent., those of Orissa 20 to 25 per cent., Mechpara Estate is placed at 49 per cent. In the United Provinces the proportion is *estimated* at 5 per cent. (which is less than the actuals of insect attacked trees for Thano alone).

Various causes bring about the death of *sal* trees but very, few of them preclude the attack by borers afterwards. The outturn of dry trees may therefore be taken in most localities as an index of the amount of damage by *Hoplocerambyx*. It is customary to assess recurrent annual damage by insects at 10 per cent. and this ratio though evidently low for *Hoplocerambyx* may be applied in the present argument.

The quantity of *sal* timber converted and in the round from all sources in India, that is damaged each year by the heartwood borer may be placed at over 1,100,000 cubic feet, of which 900,000 cubic feet is produced in Government forests. At a depreciation of 4 annas per cubic foot, the annual loss on *sal* timber extracted from Government forests amounts to Rs. 2,25,000. This loss is preventable; and the measures for its prevention exist in the prescriptions of Working-Plans that authorise dry wood or unregulated fellings. As now instituted such fellings, like other similar silvicultural operations, have no value as protective measures, because *(a)* the intervals at which they recur are too long, and *(b)* the felling or extraction of the selected trees does not take place until the season following the marking.

Protection can be assured by the adoption of the following principles:—

Sal forests that remain unworked for more than five years should be surveyed in the autumn and winter for dead and insect-attacked trees, which should be cut out and removed before the following rains. The felling should continue in the following and subsequent years in those areas where the infestation remains higher than one per cent. of the growing-stock (or alternatively one tree per acre). Except in unusually remote areas these fellings should pay for themselves. Below are given the rates offered for sound and bored timber standing in Thano forest with a lead of 4 to 8 miles to a railway station (including rates at which contractors have carried out the prescribed remedial measures).

Sale-price per cubic foot of sound and bored timber, Thano, 1917—1923.

Sale-price per cubic foot in year.	1917	1918	1919	1920	1921	1922	1923
	Normal felling and extraction.						
	a. p.	a. p.	a. p.	a. p.	a. p.	a. p.	a. p.
Sound timber	6 9	7 5	7 6	3 3	4 2	3 9	3 10
	Normal felling and extraction.			Special control fellings and extraction.			
	a. p.	a. p.	a. p.	a. p.	a. p.	a. p.	a. p.
Bored timber	3 4	2 7	2 11	0 2	0 10	1 1	1 3

The main object of subsidiary fellings of this nature is the reduction of the proportion of borer-damaged timber in the regular coupes and the consequent improvement in the reputation of the forest. At the moderate estimate of a 10 per cent. improvement the *sal* forests of the United Provinces (with an outturn of 4,500,000 c. ft.) might produce an increased revenue of Rs. 1,12,500 or nearly two annas per acre per annum. While the forests of Bengal and Bihar and Orissa might be expected on the present depreciation percentage to give an increased revenue of Rs. 70,350 and Rs. 73,250 per annum respectively.

It should be evident that it is worth while recording the proportion of dry wood in the annual coupes of all *sal* forests, and that in many divisions the institution of short cycle protective fellings would be profitable.

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THE MYSORE DISTILLATION & IRON WORKS, BHADRAVATI.

The Mysore Iron Works commenced work early last year and their output, at present, is about 300 tons of charcoal iron per week besides other valuable products of the destructive distillation of wood such as calcium acetate, wood naphtha and settled tar in commercial quantities. The works are situated at Bhadravati on the Bhadra river, about ten miles from its confluence with the Tunga river, and about 11 miles from Shimoga on the Birur-Shimoga branch of the Mysore Railways. All round the works in the Kadur and Shimoga districts, there is a fine stand of forest containing mostly *Terminalia, Cassia, Calophyllum* and *Dipterocarpus.* The present stand is expected, by the authorities, to yield wood for carbonization as well as fuel to the retorts for about 25 years. Meanwhile, the forest authorities are busy in the regeneration of some of the useful species for distillation purposes.

The present supply of iron ore is obtained from Chattanhalli about 30 miles beyond Shimoga, a haul to the plant of about 41 miles. This is only a temporary supply for the first two years of operation and the permanent supply is to come from a place in the Bababudan range, 25 miles south of the plant.

The raw materials are delivered to the plant over a system of 2 feet gauge tram lines built and worked by the Mysore Government.

The Works.—The four important sections of the works, as at present functioning, are the following; the carbonization plant where the fuel is destructively distilled in closed retorts and charcoal and pyroligneous acid recovered; the distillation plant or the chemical house where crude methyl alcohol, calcium acetate, tar and light oils are recovered from the crude pyroligneous acid;

the crushing plant where the ore and flux are crushed to a 2″ ring before being charged into the blast furnace ; the blast furnace plant where using charcoal as the reducing agent and dolomite as the flux, high grade pig-iron is made. To make the whole undertaking a success each of these sections, though separate in themselves forms an organic and dependent part in the operation of the whole plant.

The other equipment which interests probably more an engineer than a forest officer consists of a boiler plant with a 200 H. P. boiler, three 350 K. V. A. alternating current generators, three water pumping stations with a circulating capacity of 2,300 gallons per minute, foundry, machine shop, etc.

Design.—The plant was designed by Messrs. Perin and Marshal, New York, and is one of the most modern and well-equipped plants, of its kind, in existence. Eighty-seven thousand tons of hard-wood tar, per year, was the figure fixed for the capacity of the carbonization plant, thus fixing the capacity of the other plants.

Forest Officers are chiefly interested in the carbonization and byproducts recovery sections.

Wood Yard.—From the forest the billets are either loaded into charcoal buggies or stacked in the wood yard which can hold a year's supply of wood (stacked in cord wood piles $4' \times 4' \times 8'$).

Wood Distillation Plant.—The carbonization plant consists of a battery of 6 units, each unit consisting of two rectangular retorts made of steel plate with $\frac{1}{8}''$ bottoms and $\frac{3}{8}''$ tops. All the retorts are of the same size, being 54′ long, 8′ 4″ high and 6′ 3′ wide and each holds four buggies with a capacity of $2\frac{1}{2}$ cords per buggy. Each unit has its independent chimney and normally distillation in the two retorts of any unit goes on simultaneously. In general, $1\frac{1}{2}$ tons of charcoal is obtained from each buggy of four tons of wood so that in a day 72 tons of charcoal is obtained.

Carbonization Process.—Each retort is charged with four rectangular buggies containing billets of wood varying from 6″ to 12″ in diameter and about 52″ long by a light steam traction engine.

The retorts, being side by side, are equipped with duplicate doors at either end, with proper packing and swivel bolts ensuring

air-tightness during the process of carbonization. Recording pyrometers are inserted in the neck of the condenser so that the temperature of gases leaving the retorts during the carbonizing period of 24 hours is recorded.

The exothermic point is reached usually in about 6 hours after charging. It is the practice to keep the temperature, if possible, below 650° F but if the wood is too dry, it often rises to 900° during the exothermic period, in which case it carbonizes too fast, and considerable portion of the byproducts are lost. Too rapid carbonization also makes brittle charcoal.

Coolers.—After the charge is completed the charcoal is transferred to the primary coolers in which it cools, out of contact with air, for 24 hours. The coolers are of the same size as the retorts but made of $\frac{1}{4}''$ steel plate and provided with similar air-tight doors on either side. The charcoal is then transferred to the secondary coolers which are identical with the primary ones, but located in tandem with the retorts and the primary coolers. The charge is allowed to remain for 24 hours in the secondary coolers, and then, the transfer car pulls out the charcoal into the charcoal shed which is an open building 60 ft. wide × 250 ft. long. On the fifth day, the charcoal is sent to the blast furnace.

Condensers.—There are two outlets from each retort which convey the products of carbonization into two condensers which are ordinary vertical surface condensers made of copper throughout, except the water jacket which is made of steel plate. The total capacity of each is 1,500 gallons in 24 hours. They have each 195 tubes $1\frac{1}{2}''$ diameter and 7 ft. long.

Auxiliary Tank and Pumphouse.—The pyroligneous acid liquor discharges into a funnel on a liquor-collecting main which, spanning all the twelve retorts, leads the liquor to the collecting tanks. The liquor is pumped from the collecting tanks to the chemical plant by a Dean ball-valve electric-driven (all-brass) pump. The non-condensible gases are returned and burnt in the retort furnaces.

Chemical House.—The pyroligneous acid is pumped from the wooden receiving tanks, in the retort house, into 12 wooden tanks, 12′ diameter and 10′ high of a total capacity of 90,000

gallons. The settled tar is drained off by gravity, into the collecting tanks.

From the storage tanks the acid is pumped into a wooden feed tank 8′ × 8′. From the feed tank, the acid liquor goes to the copper "triple-effect evaporators" in which the soluble tar is removed by the evaporation of all the acid liquor.

The condensate from the copper triples passes on to a surface condenser liquor pen, and thence passes on to a distillate cooler. From there, it is pumped to the oil separators where the clear liquid is drawn off to the neutralizing tank to which calcium hydroxide is added and the whole mixture agitated by a propeller with wooden blades.

The neutralized liquor is pumped, by a centrifugal pump, to the settling tanks where the excess lime and sludge separate out. The settled liquor is pumped to the feed tank for the continuous still located 70 ft. above the floor line. The continuous distillating apparatus consists of an iron still 7′ in diameter, made in 6 sections, of which, three are for condensing the alcohol vapour. The steam still is very similar to that used in benzene distillation. The methyl alcohol obtained per day amounts to about 500 gallons, and the authorities do not find any difficulty to dispose it of.

The calcium acetate, of which four to five tons is the average daily production, satisfies the British Standard Specification. The authorities obtain a purity of 80 to 85%.

Conclusion.—Among the by-products of the plant, the slag of the blast furnace is utilized for railway ballast, while those of the distillation plant, *i.e.*, acetate of lime and wood naphtha have a ready market. A sample of the third most important by-product of wood carbonization, namely, settled tar, amounting to about 7 to 8 tons per day, was sent to the Forest Research Institute for investigation as to its suitability for the antiseptic treatment of timber, and the preservation of railway sleeper woods in particular. No field tests, in India, are as yet available to give us an insight as to its value for the treatment of timber. Though there is a great difference of opinion as regards its toxic properties as determined by the laboratory culture tests, the greatest

impediments to its being used for the pressure treatment are due to the large amount of free carbon present and due to its high corrosive action on iron and steel, presumably, owing to its light low boiling oils and to the presence of bodies of the acetic, formic and butyric acid type.

Crude coal tar and wood tar were tried, during the last century, for the impregnation of timber but with little success. The authorities have realized the futility of trying to find a profitable market for the crude tar, and have decided to erect a tar distilling plant with a capacity of about 6½ lakhs of gallons per year. From the distillation, it is expected that about 80,000 gallons of wood preservation oil will be recovered annually. Though no field tests in India are available, of sleepers treated with wood creosote, it is accepted generally, that it is a very valuable antiseptic. It will be interesting to see Mysore, with her 400 miles and odd of permanent way, treating with this oil her 'jungle-wood' sleepers of which several fortunately appear to be amenable to pressure treatment.

The carbonization plant, besides being the only one in India, is probably the most up to date and the largest of its kind in Asia, and is well worth a visit by Forest Officers.

The author wishes to acknowledge his grateful thanks to the Mysore Government for allowing this article to be published in the *Indian Forester*, for giving him the permission to take the photographs shown in Plate 21 and for affording him all facilities in obtaining information about the plant, etc.

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SYLVICULTURAL NOTES FROM MADRAS.

THE RESULT OF CLEAR FELLING ON A SEEDLING CROP OF "HOPEA PARVIFLORA."

The experiment was conducted in May, 1924, over an area of 6·23 acres in the Parappa R. F., South Mangalore Division, Madras, under the direct supervision of the District Forest Officer and myself.

Fig. 1. Crude Liquor Settling Tanks, Chemical House.

Fig. 2. Copper Triples.

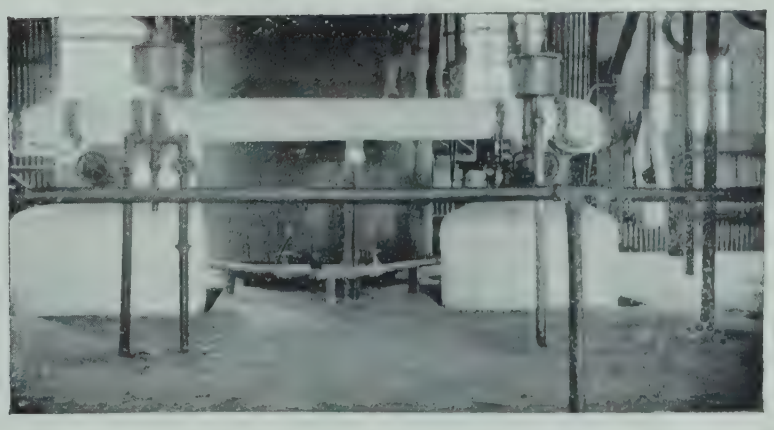

Fig 3. Alcohol Still and Boiler.

Fig. 4. Blast Furnace.

Fig. 5. General view of Blast Furnace and Chemical House.

The seedling crop is the result of broadcast-sowing in 1910-11 and during the last four years experiments have been carried out on the area to discover the effect of different degrees of shade on the seedlings of this species ; the crop therefore is not now uniform in height or density.

An enumeration of the seedlings before felling gave the following figures :—

0′–2′	2′–4′	4′–6′	Over 6′	Total.
381	1,152	2,271	3,175	6,979

A stock-mapping of the area showed blanks, as regards *Hopea* seedlings, to the approximate extent of 1·25 acres ; the figures quoted in this note may therefore be taken to apply to an area of five acres.

The operations of felling and clearing were spread over five days and an elephant was requisitioned to remove the larger logs.

The importance of felling all trees as nearly as possible with their butts towards the road was impressed upon the subordinates but the lie of the land and the shape of the trees in many instances made this end unattainable. In addition to this I was not struck with the skill of the axemen in directing the fall even of the comparatively straight stems. Apparently the system of directing the fall with ropes, or of removing the bigger branches before felling is not practised in this district, and moreover, I was assured by the local subordinates that none of the coolies could climb !

I did find one man who volunteered to climb, but it took him over 20 minutes to climb a very moderate sized tree and break off a fairly small branch, and he looked so unhappy about it that I abandoned the idea.

Looking back at the experiment, I do not think that the prior removal of branches would lessen the casualties among the seedlings to any appreciable extent, while the operation would undoubtedly tend to decrease the value of the timber by increasing the liability to shake.

I was agreeably surprised by the little damage done. Comparatively speaking, very few casualties were incurred in the actual felling, the majority being caused by the elephant while removing the larger stems. On the drag-paths used by the elephant a number of seedlings were badly damaged without being broken, though far fewer than I had expected to see, and I had most of them cut back, but a certain number I purposely retained in order to observe their powers of recovery. I selected one patch of about 100 sq. ft. and cut back all the seedlings in it and fenced it in. The progress of these stumps will be noted. I also selected 30 seedlings varying from 2′—9′ in height: these will be re-measured annually for the purpose of determining the average height increment of the plot.

The resiliency of *Hopea* seedlings is most remarkable, and had it not been for this characteristic the number of casualties must have been far larger. During the extraction I watched one seedling about 8′ high, knocked down and completely passed over by three successive logs, and on examination it was found little the worse for its treatment.

The final enumeration of the area gave the following figures: —

0′ – 2′	2′ – 4′	4′ – 6′	Over 6′	Total.
477	1,061	1,975	3,068	6,581

In the course of this enumeration the following damaged seedlings were cut back: —

0′ – 2′	2′ – 4′	4′ – 6′	Over 6′	Total.
31	69	124	127	351

The increase in seedlings in the 0′—2′ class must be attributed to the greater ease in enumerating after felling and extraction.

To summarise on an area of five acres containting some 6,600 established *Hopea* seedlings roughly equivalent to an average stocking of 6′ × 6′, (the 0′—2′ class is omitted as not being necessarily established) the casualties occasioned by felling and

extraction averaged only 100 per acre, or 7½ per cent. ; and it is to be expected that a number of those casualties will re-establish themselves in the course of a few years. The work was more carefully supervised than would be practicably or economically possible over a large area, and all species are not so elastic as *Hopea*, but the experiment can fairly be stated to have shown that the removal of the overwood from an area densely stocked with seedlings up to 9 or 10 feet in height may be undertaken with every prospect of success.

J. M. SWEET, I.F.S.,
Forest Research Officer, Madras.

REVIEWS.

INDIAN TIMBERS AT THE BRITISH EMPIRE EXHIBITION.

REVIEW : (1) THE FORESTS AND TIMBERS OF BURMA, (author's separatum) ; (2) BURMA MAHOGANY, *Timber Trades Journal*, June 14th, 1924, p. 1799; (3) LAUREL WOOD, *idem*, June 28th, 1924, p. 1957 ; (4) PYINKADO, *idem*, July 5th, 1924, p. 13 ; (5) GURJUN WOOD, *idem*, July 19th, 1924, p. 172 ; by ALEXANDER L. HOWARD.

We presume that there is in existence somewhere an official account of the exhibits in the forestry courts of the India and Burma Pavilions at the British Empire Exhibition, Wembley. As this information may be late in coming to the notice of foresters in India, it is not superfluous to draw attention to Mr. Alexander L. Howard's efforts to bring the subject before the public.

In April 1924 Mr. Howard read a paper on the forests and timbers of Burma at the Carpenter's Hall, London, at the invitation of the East India Association, and has since contributed various papers to the *Timber Trades Journal* on the forestry and timber courts at the British Empire Exhibition.

THE INDIA PAVILION.

The Forestry Exhibit is near the Central Hall of the India Pavilion. The Hall, 60′ × 40′, is panelled throughout in Indian

laurel-wood with the pillars of the arcade, framing, and moulding of the same species, and is floored with gurjun. From an entrance hall floored with Burma pyinkado, two staircases lead to the floor above ; Indian silver-greywood and Andaman's padauk have been used for the staircases. A dining-room designed in the early English style is panelled and furnished throughout in Indian gurjun with the objects of showing the usefulness and beauty of a timber practically valueless until recently, and of demonstrating that rooms can be built economically in India in a style that recalls English homes. For the ladies' boudoir the golden shades of coral wood and Indian satinee are used effectively in combination with the rich purple of Indian rose-wood. A dining room in the Georgian style is panelled with Indian silver-greywood ; the furniture is of laurel-wood with Chippendale chairs of koko. Laurel-wood is used for the billiard-room with its table, furniture and fittings.

Speaking of laurel-wood Mr. Howard says, "It is strange that after sixty years of an established forest service in India and Burma, one of the finest woods, which the world possesses, was only discovered four years ago. It is still more strange that after it was discovered it was not sought for more eagerly by all those who know fine woods. The soft colouring of Italian walnut has been approved by artistic wood decorators for more than five centuries.....In laurel-wood there is the same beautiful colouring as in walnut, but there is a greater variety of marking and figure and a much large proportion of figured wood. It stands equally well, is less costly and more durable, and the large margins of sapwood encountered in walnut are not met with in laurel-wood."

The pillars in the main structure of the India Pavilion and part of the interior of the Burma Pavilion are of teak. Three hundred teak poles of appropriate diameter were exported from Burma to be turned into pillars. Figured teak has been utilised in a bed-room suite and Indian rosewood in a dining room suite. The King's Room is so-called because the carved Kashmir walnut screens used for the wainscotting were presented to the Exhibition by His Majesty. Indian koko has been used for one chancel screen and two Parclose screens. The counters, and furniture of the exhibition bank premises are finished in

Andamans padauk and the wallpanelling of pyinma from Madras. Adjoining the bank are shops. The exterior of one is of rosewood, surmounted by a framed entablature of padauk, enclosing facia of silver-greywood, and with panel-front risers of Andamans padauk, embellished with silver-greywood. A captain's state room is made of teak with figured panels. In a Thornycroft motor launch Burma teak has been used for the hull Andamans padauk for the coamings, hatchways and deck-house and laurel-wood and silver-greywood for the cabins. In another motor launch white bombwe and white mahogany have been adopted.

In the Palace of Engineering are Pullman cars constructed of Indian gurjun decorated within by figured veneers of Andamans padauk and Burma padauk.

The Burma Pavilion.

In the Burma building is a double-fronted shop in Burma mahogany, polished in its natural colour, with the window enclosures of Burma padauk, and a flooring of parquet in mulberrywood to the stall-boards. Facing this, on the left hand, is a small shop also in Burma mahogamy, stained and polished a dark colour; the enclosure to the window is fabric covered, and the parquet flooring to the stall-board is Burma padauk. At the meeting of the main central pathways four shops form a circus, each standing at an angle, with a concave segmental front facing the centre and return ends to the pathways, those on the east side being extended to the next gangway. The shop standing in the south-west angle is of laurel-wood, selected of a dark colour, with the enclosure of laurel-wood selected of a light colour, and the parquet flooring to stall-board is of silver-greywood. The shop standing in the north-west angle is of Burma padauk with an enclosure of pyinma and parquet of gurjun-wood. In the south-east angle is a shop front of pyinma with an enclosure of tulip-wood and parquet of koko. In the north-east angle the shop front is of Burma tulip-wood with an enclosure of Burma mahogany and parquet of tulip-wood.

An exhibition bank is constructed of Burma padauk, the first time this wood has been used in important decorative wood-

work, inside this room is a bank manager's office, furnished and panelled with the same wood. Adjoining the bank is a dining-room, furnished and panelled in Burma laurel-wood, with chairs of an old Chippendale pattern in Burma mahogany. Leading from the dining-room is a ladies' boudoir in French style, furnished and panelled in Burma mahogany in natural colour Adjoining the boudoir is an early Georgian drawing-room, panelled with Burma haldu, or, knaw. The furniture in this room is Burma mahogany. The same timber has been accepted by the British Museum for the construction of natural history cabinets. In other places will be found many illustrations of various woods in different articles of furniture and use. In the grounds is an English belfry, made in Burma pyinkado, with a wheel in yellow mulberry, and a waterwharf front, also in pyinkado, showing piles, camp sheeting and capping.

With regard to Burma mahogany Mr. Howard says :—"The golden hue of the pleasant-coloured reddish-brown is enhanced and improved in appearance by the satiny lustre which is one of the most beautiful qualities that this new wood displays.

"For 200 years or more Spanish and Honduras mahogany and West and East Indian satinwood have held one of the principal places, if not the principal place, in the world of artistic furniture. As a rule Spanish mahogany darkens with age and exposure too much, so that its first colour is more attractive, and as it grows older it becomes less attractive. Honduras mahogany at first possesses a more or less unpleasant appearance, but with age and exposure attains a dull yellow-grey colour which, at any rate to me, is the most pleasing tone of colour which any mahogany can assume.

"Satinwood, on the contrary, which to most people seems too glaring and lurid at first, gains with age and exposure an exquisite tint of rose-yellow or gold—an appearance which the modern furniture-man endeavours to acquire by artificial means, without success.

"The link between these different colours, and to my mind the best tone of all, is that lustrous tone which the Burma mahogany displays."

Other purposes to which it has been put can be seen both in the India and Burma Pavilions as follows:—Pedestal writing-table; school-desks and seats; gramophone-cabinets; mantle-piece clock-cases; electric light floor and table-standards; tobacco-jars and tea-caddies; trouser and tie-presses; hair-brush backs, military type and ordinary; hat and cloth-brush backs; surveyors' levelling staves; music-cabinets; tea-tables in nests of three; gate-leg tea-tables; drawing-room folding cake-stands. There is on the lake a special boat made in this wood, called the "Empire" used for distinguished visitors to the B. E. E.

Mr. Howard lays stress on the unique qualities of pyinkado or the ironwood of Burma. Considerable quantities in sizes up to 3 feet diameter are now in London ready for use and arrangements have been made for a continuous supply in the future. In view of the great increase in the cost of labour it is of first importance that constructional work should be carried out in a material which possesses the longest possible life. The constructive timber work of pyinkado should last four times as long as that of pitch pine which is alternatively used, possibly ten times as long, for in the more trying climate of Burma it has remained sound for 200 years. In such undertakings as docks, ship-building yards, railway-works and wharves, an opportunity has been opened up by the use of this durable timber. The wharfage front at Lea Wharf, Canning Town, has recently been constructed of pyinkado, but cappings of other timbers have been used in places for the experimental comparison of their wearing qualities with that of pyinkado Mr. Howard states that the timber is entirely immune from the attack of borers, but we have seen logs seriously damaged by shot-hole borers, principally *Xyleborus sordicauda*, Motsch, and *X. andamanensis*, Bldfd.

It is estimated that Burma can produce 300,000 tons of pyinkado per annum without interfering with the prospect of future supplies.

The timber of Gurjun wood is strong, actually stronger than British oak, hard, and yet not too hard to work of an agreeable colour and a very good grain. For use in factories for both constructional and decorative woodwork, in

offices for decorative woodwork, in private houses, schools, hospitals, and the like, it possesses advantages equal to those of any timber which is ordinarily used. "By degrees, in the course of the last few years," states Mr. Howard, "we have found that it possesses three strange, unexpected qualities which other timbers lack. These are as follows:—

"1. The room or hall in which the wood is used gives a sweet and fragrant scent; this is so persistent that ten years after the flooring was put down in my brother's house I was still conscious of the fragrance the moment I entered the house.

"2. Long floorings as well as block floorings made of this wood are as silent to the tread as linoleum.

"3. A room panelled and furnished with gurjun remains cool in excessively hot weather, when adjoining rooms are exceedingly stuffy and hot.

"The scent is so readily noticed that it is not necessary to produce any proof. The silence of the flooring was discovered by the vicar of a church upon his having gurjun flooring laid in lieu of stone in the aisles. Throughout the summer the visitor will be able to prove for himself the truth of my claim, as to the coolness of the room, by visiting the Forestry and Timber Court in the India Pavilion at the British Empire Exhibition, when he will find that, however hot the day, upon entering the Gurjun room it is deliciously cool. The dining-room at the back of this room has an opening direct to the corridor which leads into the open air, and yet this room is never cool like the 'Early English Room.'

"In strength this timber is stronger than British oak, and, strangely enough, upon testing for breaking, it has been found impossible to entirely sever the timber, as a thin stand remains like a hinge which has not broken....."

Arrangements have been made for a plentiful supply of all descriptions for the future. The colour of the timber is much the same as that of teak; when first cut, perhaps a little lighter and redder, but maturing with age to practically the same colour.

Photo.-Mech. Dept., Thomason College, Roorkee.

SWIETENIA MAHAGONI.

The grain is close and compact, with a marked absence of hard and soft layers, showing a very even. regular surface. The weight when dry ranges from 42—50 lb.

Among the exhibits of timber in the round and squared log are two Spanish mahogany trees that grew in the Botanical Gardens, Calcutta. These were felled last year and transported to Wembley. The larger log weighs over 10 tons, is 6 feet in diameter at the butt end and contains 4,000 feet of board timber; its age was 113 years. The smaller log weighs just over 4 tons, is 4 feet in diameter at the butt, and contains 1,600 feet board measure; its age was 82 years. The accompanying photograph of the larger tree is from the Forest Research Institute collection. [*Vide* Plate 22.]

Mr. Howard draws attention to the fact that in 1920 the United Kingdom spent nearly £, 90,000,000 on imports of timber. For common oaks from America alone the bill was nearly two millions. Yet the Indian Empire apart from teak contributed timber to the value of less than £ 43,000. Such figures go far to justify the recent declaration of an American survey of the world's timber resources that the forest resources of India "have barely been touched."

From the standpoint of personal experience Mr. Howard recounts the difficulties placed in the way of those who attempt to introduce into regular commercial use any new timber, which are so great and so varied as scarcely to be credible to the uninitiated. Most of those who have attempted the experiment have either given it up or been ruined. The new timber is criticised by everyone; guarantees are asked for on all sides; people rise up from all quarters to attack it; it is examined as with a microscope, and all kinds of pains and penalties are proposed, to be inflicted for each trifling defect. He has been able to show, however, that notwithstanding difficulties of this kind much has been accomplished in the last three years in the introduction of timbers of India and Burma for commercial use. In the case of many kinds, instead of it being difficult to find a demand, there has been more trouble of late in assuring supplies.

C. F. C. B.

URDU TEXT-BOOKS OF FOREST UTILIZATION AND SILVICULTURE.

REVIEW : (1) MASARIF-I-JANGLAT *or the vernacular translation of Mr. Troup's "Indian Forest Utilization"*; (2) TARBIAT-I-JANGLAT *or the vernacular translation of Mr. Jackson's "Manual of Silviculture,"* by MAULVI ABU YUSUF AHMAD MOHI-UD-DIN FARUKI, *Assistant Nazim of Forests, Hyderabad. (Deccan)*, without date and price.

The books are literal translations of Mr. Troup's "Indian Forest Utilization" and of Mr. Jackson's "Manual of Silviculture." They are the first of their kind in the Urdu language. They have been written for the use of the Local Forest School, Hyderabad, and Urdu-knowing Indians. All the illustrations given in the original books have been printed in the translations. The translator has produced a very useful work and it will be of great interest to Urdu-knowing forest subordinates, contractors and traders, and we have no doubt that it will fulfil the object of the translator. At the end of the books an index has been given to show the various local vernacular names of the trees and shrubs mentioned with their corresponding scientific names.

The translator has fulfilled a want in supplying Persian or Arabic synonyms for technical English words although some of them might be thought defective. In some cases, he gives very unwieldy Persian or Arabic words which are not in every-day use and it would be better if simple Urdu words were substituted for them. For instance, he gives *mulkhasat* for extracts, *imkanah* for buildings, *muadin* for mines, *cholinah* for timber, *habub* for seeds, *muquaomat* for resistance, *hezami sokhtni* for firewood, *lakri ki purnian* for wood vessels, etc, etc. The simple Urdu words *sat, makanat, kanen, imarti lakri, bij, muqablah, jalane ki lakri, lakri ki ragen*, etc., etc., would perhaps be better. We are given *sahra* for forest, *pate* for stems, *are se lakrian katnan* for sawing of scantlings, and these are not correct. The better and correct words are *jangal* for forest, *tannah* for stems and *karion ke chiran* for sawing of scantlings. Further in some cases it would have

been much better had he not given the Persian or Arabic synonyms for those technical English terms which are already commonly used in Urdu in preference to his Persian or Arabic synonyms, for say the following terms:—Standards, Working Plan, compartment, coupe, high forest, coppice, possibility, selection method, uniform method, clear felling, group method, improvement felling, cutting back, normal forest, etc., etc.

In our opinion in the next edition these and other English terms should be reintroduced, and simple and common Urdu words should be preferred to high sounding Persian and Arabic words.

It is hoped that the translations will fulfil the objects with which they have been published; and the Urdu-knowing people should be grateful to the translator for his placing within the reach of Urdu-knowing employees the knowledge of the practice of Forestry.

GURDIT SINGH.

THE EFFECT OF FIRES IN THE PINE FORESTS OF CALIFORNIA.

REVIEW: THE ROLE OF FIRE IN THE PINE FORESTS OF CALIFORNIA, by SHOW, S. B., and KOTOK, E. I.,

U. S. Department of Agriculture Bulletin, 1924.

The Department of Agriculture of the United States has just issued a Bulletin from the Forest Service by S. B. Show and E. I. Kotok, entitled "The Rôle of Fire in the Pine Forests of California." In this very interesting treatise the authors trace the influence that fires have exerted in the mixed pine stands of California from the earliest known history as noted and recorded in the trees themselves, up to the present day. It is shown that the present stocking of old growth stands is largely the result of past fires, which have so culled the forest that the yields from the old ragged forest as now left to man are much below those which can be expected from the second-growth stands when fully stocked. Fires in the old growth virgin forest have affected the

destruction of the largest and most valuable individual trees largely through the enlargement of basal firescars. These basal-scars, gradually enlarged by repeated and often very light ground-fires in the litter, so weaken the tree that later on it is broken off by the wind or through a reduction in strength brought about by the entrance of fungi or the loss of wood volume.

In the California pine forests, there are no crown-fires as are known in other forests and other regions. Most of the fires are comparatively light, running along the surface of the ground and consuming only the forest litter and lighter fuels. The effect of these fires in the past has been overlooked for the most part as they lacked the spectacular features associated with the more destructive crown fires. They, far more than has been supposed, are responsible for the uneven-aged and broken stands so common in the Sierras, for the process of attrition is a slow one and not often recognised.

Not only is there a reduction in the quantity of wood produced in these forests, and a reduction in the number of trees through a continuous loss of young growth, but there is also a loss of site quality due to the reduction in the humic content of the soil. This is further reflected in the growth, for the killing of a portion of the cambium, the reduction in amount of leaf volume, and the other injuries to the tree direct and indirect, all combine to reduce the rate of growth of the individual. In addition, inferior species are encouraged.

It is pointed out that systematic fire protection is positive in its action rather than negative and has for its object not merely the prevention of loss, but the building up of the forest and of the quality of the land. It is not merely an added cost of production nor is it a part of what has been termed "over-head cost;" it is a part of the capital investment.

Fire should be recognised, not merely as an enemy of the timber-crop now standing, but as the ruthless foe to the very existence of the forest, a foe whose destructive work is always cumulative, for the final effect of the fire is to reduce the forest to brushfields or to scrub.

The uses of fire, such as burning for grazing and similar purposes, are incombatable with timber growing. With rising timber values, grazing will undoubtedly become secondary to silviculture on all forest land. In the California pine region, trees are a more profitable crop than forage, and it has not yet been proved that fire is the friend of the grazier as he has been in the habit of considering it.

Because of the similarity of conditions in California to those of the forests of India where the chir pine predominates this bulletin should be of great interest to those foresters especially working in the Indian pine forests.

E. N. M.

CREEPING FIRES.

REVIEW: THE DAMAGE CAUSED BY CREEPING FIRES IN THE FOREST, by S. L. KESSELL, CONSERVATOR OF FORESTS.

Bulletin No. 33 of the Western Australia Government, 1924.

In European practice, it goes without saying that if a forest is under systematic management, it is fire-protected, and the reasons for this are often considered so obvious as to require no explanation. In countries where scientific forestry is of more recent introduction, it may be seen over and over again, that attempts are made with varying success to initiate this policy, but that sooner or later, there follows a reaction. It is asked whether the results are commensurate with the energy and money expended, and the answer is commonly found in a compromise in the form of the recommendation of some kind or other of "light burning." It is not difficult to find arguments which the layman can understand in support of this idea; in fact if the layman is personally affected, and is anxious to get the forest burnt somehow or other, he will back up these arguments to a degree liable to be embarassing to the trained forest officer, who is more than likely to feel that he is being urged against his instincts in the matter. Most often, the forest officer, having seen the results of

his own and his predecessors' efforts at protection, continued over many years, go up in smoke, becomes an unwilling convert, he admits that though, light burning is not good for the forest, it does less harm than a periodic holocaust at the height of the worst seasons after a period of successful protection.

India has encountered this problem to a severe degree, and after a long period during which universal fire-protection was almost a fetish, a strong reaction has occurred which some may think is tending to go too far, but which probably all admit is justified under certain conditions. It is, therefore, specially interesting to us in India, to read the experience of other countries in this matter, and we have before us an instructive pamphlet dealing with the conclusions reached in the coniferous forests of the Pacific slopes of the Rockies, from the pen of an experienced officer of the Western Australian Forest Service, Mr. S. L. Kessell.

The bulletin under review is mainly a reprint of an article published in the July 1923 number of the Portland *Timberman.* The foreword justifies the application of U. S. experience to the eucalypt forests of Western Australia, in terms which might be transferred almost verbatim to many parts of India, with a change only of the names of the trees.

It must be remembered that the Pacific slope forests are purely coniferous, and so would be expected to be comparable with the coniferous forests of the Himalaya, but just as the deductions made from observations in the former are applicable, in Mr. Kessell's opinion, to the W. Australian gum forests, with the chief difference that fire-damage is often less obvious in broadleaved crops even when equally existent, so also it is likely to be useful to see how far they may be applicable to the numerous types of forest we have in India.

In dealing with forest problems in the U. S. A., technical foresters there have the advantage of getting a second point of view which is unlikely to be biassed in the same direction as their own on any matter, we refer to the opinion of the big timber owners who speak from practical experience with little danger of unconscious reproduction of views derived from the text-books.

It is, therefore, of interest to note that a special Committee of the U. S. Forest Service, the University of California, and two of the biggest timber owning bodies in the West, after three years' consideration, discard light burning as unquestionably injurious, and unequivocably advocate absolute fire-protection as both preferable and practicable.

No less than fourteen points (the number evidently has special significance in the U. S. A. !) are marshalled as having been put forward in support of light burning, as compared with a mere six against it, and so 14 fallacies have to be exposed if an adverse verdict is to be given. In view of the importance of the problem in India, and to the difficulties now being experienced in the Himalayan forests through uniformed political support of the practice of so-called light burning, to meet the demands of village populations, that believe in all of the 14 fallacies which they think affect them adversely, it is worth while to reproduce these points *in extenso,* though we have not space to discuss them all in turn :—

THE CASE FOR LIGHT-BURNING.

"1. That before the advent of absolute fire-protection, fires caused no great damage to timber because fires ran over the forests at intervals and prevented the accumulation of much inflammable débris.

2. That light-burning is practicable in all pine forests, and will prevent damaging fires.

3. That as a result of the practice of fire-prevention, great amounts of litter have accumulated, which result occasionally in very damaging fires.

4. That the fire-prevention policy was introduced from Europe, and that since there the inflammable material is removed by hand, the fire-prevention policy is not applicable to this country.

5. That the damage to mature timber by the practice of light-burning is negligible.

6. That fires do not fire-scar living trees.

7. That the clear trunks of much of our virgin timber is due to the occurrence of fires.

8. That fires kill the destructive bark beetles in the standing trees and that, therefore, fires control epidemic infestations and prevent their recurrence.

9. That the smoking and charring of the bark of living trees by fire prevents the entrance of insects into such trees.

10. That fire is a cleansing agent and fills the same function in the forest that disposal of refuse does in the cities.

11. That reproduction is undesirable in the virgin forest, because it hinders the group of mature trees.

12. That fire has a beneficial, selective action in dense stands of reproduction by thinning out the weaklings, and bringing the stand to the desired density without entirely obliterating it.

13. That brush fields within the timber-belt are not the result of fire, but are natural phenomena.

14. That light-burning prevents serious fires and that disastrous and uncontrolable fires will result from the accumulation of litter brought on by complete fire-protection.

THE CASE AGAINST LIGHT-BURNING.

1. The losses to merchantable timber by light-burning are considerable; by burning down of previously fire-scarred trees or fire-scarring uninjured trees to the extent that they are subsequently blown down by wind and storm; by actually killing trees due to heat of the fire; by cull and reduction in the grade of lumber due to fire scars and more rapid action of wood-destroying fungi; by greatly increasing the activity of tree-killing beetles; and by the reduction of growth of thrifty merchantable trees.

2. The damage to reproduction by repeated light fires is sufficient to make impossible the permanent production of timber.

3. Light-burning results often in the enlargement of brush-fields and the crowding-out of the forest where it once grew satisfactorily.

4. The grazing resources of areas which are lightly burned are gradually reduced in value because of the practice.

5. The difficulties of actually carrying out light-burning operations are tremendous and cannot be overcome at a cost many times in excess of the cost of systematic fire-protection.

6. The use of even regulated fires in the forests results in an attitude towards fire-protection on the part of the public which is hurtful to forest protection in general. It develops the feeling that special precautions to prevent fires are not needed since fires often do not result in much damage to merchantable timber any way. Even the most enthusiastic supporters of light-burning are anxious that those who use the forests exercise all possible care to prevent and suppress fires."

One detailed study revealed that with the lightest fire possible in *Pinus ponderosa* forest, 2 per cent. of the trees were killed off at once and a much larger number in the course of the next four years, and similar deductions follow from other observations. The Committee decided that..."*No burning yet critically studied failed to cause damage to mature timber, which was considerably larger than would be apparent to the casual observer.*" That the gradual felling of large trees through basal scars catching fire annually involves such unexpectedly high loss has been shewn by Mr. A. E. Osmaston for *Pinus longifolia* (cf. *Indian Forester*, 1914, pp. 387—391).

It may be admitted at once that in the Himalaya, the "bug" problem is not so serious as in the Far West, but it is of interest to note that in some parts of America it has been clearly proved that light burning is followed by an increase of several hundred per cent. in the pine-beetle damage.

As regards the effects on reproduction, which have also been made the subject of many investigations in the U. S. A. (notably by Show), Mr. Kessell's summarising remark, agrees, as far as it goes, exactly with the present writer's view and is..."The fact that light fires do not uniformly thin out the reproduction on the burns, but entirely wipe it out in considerable parts of them, is perhaps the most important point to remember in connection with the effect of light burning on reproduction." The often

extremely adverse effect on the quality of the trees originating from such injured reproduction is also not overlooked in this bulletin.

The question of the effect of light burning on the grazing resources of forest is unfortunately not further discussed—a careful investigation of this matter is one of the urgent requirements of forestry in the Himalaya—but that it is deleterious is accepted as proven. As regards undergrowth; the bulletin under review does not clearly distinguish between light burning and severe fires, but brings out the facts that firing generally may encourage brush, and may indeed result in the complete replacement of forest growth by brushwood almost devoid of timber. That whether a forest is subject to firing or not, may decide the relative proportion of the various tree species comprising it, is also recognised (cf. *Indian Forester*, 1923, pp. 116—135, for a discussion of this as affecting forests in the C. Himalaya). Whether the more or the less valuable timber species will be favoured, will be largely a matter of chance.

Two points worth special note remain to be dealt with. One is of great importance in a country which is thickly populated by people who, with or without good reason, are strongly prejudiced against fire-protection, and that is the great difficulty attending an attempt to practice both methods in any given district or type of forest, as has been proposed, and tried for that matter, in some parts of the Himalaya. The population has to be an exceptionally highly educated one if it is to realise that fire is the worst of all possible evils on one side of a valley, say, and permissible on the other side, in a forest all of one tree species; it is asking too much to expect differentiation between the several stages of regeneration and subsequent development.

The second matter is one of finance. It has been realised in the U. S. A., as doubtless wherever else it has been tried, that light or "controlled" burning is a far simpler matter on paper than in the forest, and again, even when it is quite feasable to carry out successfully any given method of burning on a moderate scale, it is a very different problem to treat large areas in similar fashion. It is very difficult to decide just when to burn, and the

suitable time, in any case, may be of very short duration. What is simple in one year, may be almost impossible the next under different weather conditions; the cost incurred may easily be greatly enhanced, and even then, the forests may be in part insufficiently burnt to afford that subsequent reduced risk claimed as a special advantage of the procedure, and in part burnt by a fire by no means either light or controlled. These aspects of the problem apply with greater force to forests in hilly areas. Another difficulty is to decide what expenditure is justified, since if one favour light burning whilst admitting that it does damage, one can spend almost any sum in preliminary operations to reduce, such damage—a case is quoted of a large scale experiment in this direction costing some Rs. 3 per acre, with which may be compared the average figure of 9 annas per acre successfully protected for the submontane *sal* forests (95% success is attained) and 8 annas per acre similarly for pine forests in Kumaon. This problem so difficult of solution, of the justification of preliminary expenditure on clearing round the base of trees and so on in an area to be lightly burnt, becomes of first importance in our pine forests which are under resin-tapping, and is, it is believed, being experimented on in both the Punjab and the U. P. Mr. Kessell summarises his observations in the U. S. A. in the following words:—"*Aside from the damage which is done to merchantable timber and reproduction by all these varieties of light burning, the actual carrying out of the burning is full of practical difficulties, and the cost is excessively high in comparison with the results secured.*"

This applies primarily to the coniferous forests of the Rockies, is believed to hold for the gum forests of W. Australia, and is equally, true of the pine forests of the Himalaya.

The special firing of regeneration areas in both broad-leaved (*e.g., sal*) and coniferous forests after seeding fellings, is a separate problem introducing very different factors, and on the whole simpler to study, whilst the burning of evergreen forests under totally different climatic conditions, has also to be dealt with independdently though some of the 14 *pros* and the 6 *cons* still apply.

C.

CORRESPONDENCE.

[NOTICE—Correspondents who wish their letters to appear in a particular number of the *Indian Forester* should ensure that they reach the Honorary Editor by the 15th of the previous month. Unless exceptionally long they will be inserted.]

THE DAMAGE CAUSED BY CREEPING FIRES IN THE FOREST.

SIR,—A pamphlet under the above title by Mr. S. L. Kessell, Conservator of Forests, Western Australia, has attracted my attention. It deals with the results of repeated light burning of forests in California. Ever since that system was introduced into the Indian forests, I have felt uneasy as regards the results in the long run. The system seemed to me opposed to common sense, and I was repeatedly tempted to protest against it publicly. I have not done so, but now that experience in California has brought out the serious damage done by the system in the long run, I cannot omit suggesting your publishing Mr. Kessell's pamphlet in the *Indian Forester*, hoping that the Indian foresters, who have favoured the system, may be induced to reconsider the matter once more before irretrievable mischief is done.

It has always been my opinion that fire may be used to clean the ground when regeneration is to be attempted, but when that process has been set on foot, there should be no second or further burning, but real fire-protection and accompanied by real tending, in other words, weeding and cutting-back of undesirable growth until the main crop is capable of holding its own. The cost may be heavy at starting, but it is sure to decrease if the system has been developed on small areas and is gradually extended. At any rate it will lead to tangible results, whereas repeated light burning leads nowhere as far as regeneration is concerned, but does great harm, as shown in the above mentioned pamphlet.

W. SCHLICH,
Oxford.

[We regret that we are not able to give full effect to Sir William Schlich's suggestion as the bulletin by Mr. Kessell is too long to be reproduced *in extenso* in the *Indian Forester*. But we have secured a review of the bulletin that appears elsewhere in the present issue.—Hon. Ed.]

THE REGULATION OF THE YIELD.

SIR,—The extract of Mr. Trevor's contribution to *Empire Forestry* published in the July *Indian Forester* mentions the calculation of the yield and the regulation of the yield, and the reduction of areas felled over to compensate for differences in crop.

One is at times caused to wonder whether all this calculation is not rather overdone; now we do not hear so much about the so-called "Soil-expectation-value" so would it not be a good thing to draw a veil over the calculation of a sustained annual yield as well. All these things would be very necessary if one was managing a small estate for an owner who was not prepared to "put away a bit" in a good year to stand him over a bad year later on.

I suppose that in the end the thing that counts is the revenue of the Forests of India as a whole, and beside that the revenue of a single division is somewhat small. However even if one narrows down the field to the forest revenue of a Province, there are probably some twenty divisions that contribute to that revenue; but the revenue of the division is split up too. A division may be formed of a large number of small felling series and a coupe worked over in each felling series each year, or the felling series may be larger and several coupes may be taken up in each felling series each year, or the felling series may be one and the same thing as the working circle, in which case it is a mere exaggeration of the second form. Whatever the form, the fact remains that a number of coupes are taken up each year in the division in different places. It is very doubtful whether the number of bad, medium, and good coupes varies very much in the division from year to year, as there are a large enough number of coupes wherewith to strike an average. (At the last auction I attended we sold or tried to sell 60 coupes.) It is still less likely that the percentage of these three qualities of coupes varies very much in the province from year to year, and even less likely that it varies in the whole of India. Hence the revenues of the various units would not vary much, that is if quality were the only

matter that affected the revenue. What makes our efforts to regulate revenue so futile is the timber market, and a rather striking example is given in the same *Indian Forester* when speaking of the Punjab Administration Report, where it is stated that the value of timber has dropped by two-thirds in about the last three years.

The obvious point which unstitches my argument, is the case of a division which fulfills a contract every year to supply timber, or where there is some peculiar and fixed demand that has to be met, but this must be very rare or probably does not exist. The average division sells to contractors, who will take every stick of the usual species that sell and will almost always find a good market even in a year when prices are low. Further there is little hardship on the contractor, in the very unlikely event of his favourite division not having coupes that suit him one year, as there are very few contractors who deal with only one division, and so he is able to take more from another division from which he is also in the habit of buying.

It appears to me that the simplest method of regulating a sustained annual yield (if this must be done), is to take up a large felling series and decide to take out 3 or 4 coupes for each year in different parts of it. Then decide what 30 or 40 coupes should be taken up in, say, 1930—1940, regarding the matter from the silvicultural point of view. Then without undue strain on the silvicultural requirements of the crop, it will be possible to average up the yield in each year by picking a bad coupe to play off against a good coupe and brigading them with a couple of medium coupes, perhaps the next year four medium coupes will be chosen, choice being guided by the silvicultural requirements and the idea of averaging up the coupes from year to year in each felling series. In the case of 'single coupe' felling series, it is perhaps possible to play off the good coupe of one felling series with a bad one from another when trying to even up the annual yield.

I do not see that this scheme is in any way more likely to go against the silvicultural requirements of the species, any more than the usual forms used of regulation do.

As regards the deciding as to which is a good coupe, etc., I think that an inspection of the crops should give a good enough

idea for most purposes. The quality class is not much guide in uneven-aged forest as it does not indicate the sale value of the coupe, but it would do so, I presume, in even-aged forest if it is to be sold at maturity.

In conclusion I would disclaim any idea of being a discoverer of matters which have probably already been discussed and condemned, or are possibly in use. I also wish to express a hope (very faint) that you will not find my remarks too puerile, but I will explain all by signing myself

VERY JUNIOR.

OECOLOGY OF INDIAN SAVANNAH PLANTS—A REJOINDER.

SIR,—In the May issue of the *Indian Forester*, Mr. R. N. De offers criticism on the above article. The œcology of plants is admittedly "a subject still in its infancy" and about which considerable difference of opinion is possible, but I am afraid, much of Mr. De's criticism is based on misunderstanding of the purport and scope of the article, and, in certain cases, Mr. De has been so much carried away by his enthusiasm as a critic that he has not called a spade, a spade.

Thus, for instance, in criticising the stress laid by me on the importance of light, Mr. De writes: "There is no reason why light should be the only determining factor in the condition of growth of a plant." I agree with Mr. De that light is not the 'only' determining factor, but surely it is one thing to say that light is the only factor, and another to say that light is a factor of *dominant* importance in this case. I have mentioned clearly in that article that there is not one, but three main factors, which govern the entry of a 'pioneer' species in a savannah and that "these factors work in conjunction." Further, without minimising the importance of any, I tried to show that light exercises a predominating influence. Mr. De has thus attributed to me a statement which I never made, and has actually gone to the other extreme of calling in question the undoubted importance of light in relation to plant life. The following extract from Mr. Hole's publications will show that in certain cases light may be a factor of dominant importance :—

"As indicating how an insistence on the primary importance of the water-supply may quite possibly obscure the vital factor of dominant importance, we may take the case of those evergreen trees which exist in regions of moderate rainfall.....No forester doubts the extreme importance of light as a factor capable of influencing the distribution of plants, and in the case of the sal, its capacity for withstanding a considerable degree of shade is almost certainly the factor of most importance in enabling it to gain a footing in forests of miscellaneous species and to form gregarious forests of its own. Dimunition in intensity of light however, must to some extent mean less assimilation and therefore less vigour for growth and vital functions and from this point of view it can be understood why a plant, which has become adapted to the utilisation of diffuse light and which has to compete in the struggle for existence with plants which can utilise light of greater intensity, should find it advantageous to maintain its foliage throughout the year. At the same time, the fact that foliage has to persist through unfavourable seasons.....explains why a somewhat xerophilous structure should characterise the foliage. *The dominant factor, therefore, which here seems responsible for the existence of a remarkable type of vegetation appears to be not water but light.*" (italics are mine).

As in the case of the above evergreen species, so also in the case of 'pioneer' species intruding into savannahs, the dominant factor is the same, *viz.*, light. This is proved by the fact that in each of these plant communities, the prevailing characteristics are similar, *viz.*, notable capacity to withstand shade, and a more or less xerophilous and evergreen leaf-structure. If, therefore, I laid stress on the importance of light, in this case, I did nothing more than call attention to a truism, which according to Mr. Hole, is liable to be ignored.

Similarly in referring to the distribution of *D. pentagyna*, Mr. De triumphantly comes to the conclusion 'so frost is not obviously the only cause of its absence,' but here again Mr. De has clearly misunderstood me if he thinks that frost is alleged to be the 'only' cause, for all that is intended is that frost exercises a predominent influence in that case.

Mr. De mentions a few 'small-leaved' species which he says are found in savannahs. I am afreaid Mr. De has here confounded the word 'savannah' with grassland in general. The species mentioned by him undoubtedly occur in certain grasslands but not in true 'savannahs.' It was in order to avoid any such confusion that Mr. Hole divided grassland into three distinct categories. Mr. Hole's definition of a savannah is as follows :—

"A *savannah* covers the more strongly mesophilous and hygrophilous grasslands, a *meadow* the less strongly mesophilous grasslands, and a *steppe* all xerophilous grasslands."

The following chart which is prepared from Mr. Hole's "Œcology of Indian Forest Grasses" shows his distribution of these grasses into the above categories and the parallel woodlands :—

	Xerophilous	Mesophilous	Hygrophilous
	Steppe.	*Meadow or Moist Savannah.*	*Wet Savannah and Reed Swamp.*
Grassland.	Andropogon monticola. A. contortus. Aristida cyanantha. Triraphis madagascariensis. Sachharum spontaneum S. Munja (xerophilous form.)	S. Munja. S. Narenga.	E. Ravennæ. E. elephantinus. Phragmites. Arundo. S. arundinaceum.
Prallel woodland.	Open woodlands of such species as— (1) D. Sissoo. (2) A. Catechu. (3) Tamarix. (4) Prosopis. (5) Capparis. (6) Salvadora. (7) Ephedra. (8) Orthanthera. (9) Zizyphus, etc.	'Deciduous' and 'hill' forests of such species as— (1) Sal. (2) B. malabaricum. (3) O. Wodier. (4) H. antidysentrica. (5) K. Calycina. (6) G. pinnata, etc.	Tropical evergreen forest and moist miscellaneous forest of such species as— E. Jambolana. T. nudiflora. Terminalias. A. cordifolia. C. australis, etc.

It will be seen that many, if not all of the species mentioned by Mr. De, occur in what is properly speaking a 'steppe' and not a true 'savannah.' In my article, I have tried to follow the classification laid down by Mr. Hole, and it is because Mr. De has ignored this classification that he has lost bearing and drifted beyond the scope of my article. In this connection it may be mentioned that Mr. Hole's definition of a savannah differs from that of Schimper as well as Warming, but it will be conceded that in dealing with Indian forests, Mr. Hole's classification of grasslands should be strictly adhered to. It is true a 'steppe,' in certain cases, fades insensibly into a 'savannah' for which reason 'small-leaved' species found in a 'steppe' may be found in a 'savannah', but obviously such abnormal cases should not be considered in theoretical discussions about true savannahs.

Finally, I must consider at least one more statement of Mr. De. He writes "if the premise that big-leaved species grow more quickly be correct, we should not expect to see *B. frondosa*, for instance, among the slow growing species and *kail* or *Casuarina* among the fast growing species." Here again Mr. De puts certain words in my mouth to which I can never subscribe. I have never stated that the growth of a plant is proportional to the size of its leaf, that big-leaved plants necessarily grow faster than small leaved plants or *vice versâ*. Growth, like many other complex phenomena is a resultant of several different factors, *e.g.* light, the aggregate assimilating surface of a plant, strength of nutrient solutions, etc., but in considering these factors one cannot help adding that *other things being equal*, bigger leaves assimilate comparatively more rapidly than smaller leaves, particularly considering that expansion of leaf laminæ is a convenient adaptation to absorb diffuse light with which the seedlings of these 'pioneer' plants have to remain content. A familiar example of this adaptation exists in the case of silver-fir which can develop under dense shade of say *kail* or deodar, partly because of its bigger leaves, but while this contrivance is most useful to absorb diffuse light, it does not follow that silver-fir should grow more rapidly than *kail* or deodar. The following statement

from Warming shows the effect of reduction of leaf surface "By increasing the number of leaves the plant strives to compensate for the *decreased assimilation that is caused by reduction in their size.*" (italics are mine.) If reduction in size of leaf surface produces 'decreased assimilation,' then increase in leaf surface must lead to increased assimilation. This is all what I stated in my article, but from these perfectly sound premises Mr. De drifts to certain conclusions (*e.g.*, comparison of *B. frondosa* with *kail*) which conclusions turn out to be absurd, but these deductions are not mine but Mr. De's own.

SHER SINGH,
Assistant Conservator of Forests, Kashmir.

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HAY COLLECTION IN MALNAD STATE FORESTS, MYSORE STATE.

Owing to the scarcity of fodder in the Maidan Districts of the State, the Government of Mysore directed that the state forests of the Malnad and Maidan Districts of the State be thrown open to grazing as a first step to relieving the distress. The Maidan jungles could not supply the necessary fodder for the local cattle and it was therefore resolved by Government that the Agricultural Department should get together the Maidan cattle into small herds and march them to the Malnad forests to tide over the situation.

The length of the proposed march was about 150 miles on an average. It was arranged that at chosen centres at convenient distances, on the way, baled fodder be stored for supply in temporary depots. The Forest Department was, meanwhile to go on collecting and baling fodder grass in the forests, loose hay being stacked in ricks in the jungle for consumption by the incoming cattle and baled stuff for shipment to the camps on the route.

The original estimate of the required collection was between 4,000—6,000 tons of loose hay of which 500 tons had to be sent out baled to the several camps for the use of the marching herds.

The Forest Department started hay collection early in December 1923 but it was not till the first week of January 1924 that the work of collection was in full swing. Baling commenced from the middle of the same month, just about the time the writer of the report was placed on this special duty.

Owing to the large quantity of grass required in a short time, collection and carting was started in twelve forest ranges, employing in all 900 coolies per working day on an average. The collection and stacking at the site of collection was therefore complete by the middle of February 1924, and the tonnage reached was 2,000 tons for the two forest divisions of Bhadravati and Shimoga.

The shipping of baled fodder was steadily going on from the 15th of January 1924, from the three railway stations, Shimoga, Masarahalli, and Tarikere, on the Mysore State Railway. The bales were being booked to cattle camps stations on the M. & S. M. Railway within the State limits originally fixed by the Agricultural Department. The quantity of baled hay booked to cattle camps came to 480 tons by the 2nd March 1924, nearly completing the programme in this particular. Baling operations were, therefore, suspended in nearly all the centres—there were 5 such—from the end of the first week of March 1924, until Government issued revised instructions to bale all the loose hay on hand. The reason for this revision of the first programme was the failure to fight the prejudice of the Maidan ryots to bring out their cattle from their poorly wooded tracts to the dense jungles of the Malnad, which in their wild imagination was the land of lurking tigers and panthers ready to devour their cattle and of fantastic grim shapes ready to care for them as the wild animals would their cattle.

By this time the demand for baled hay had increased largely owing to the wide publicity given to the resolutions of Government and the increasing belief of the ryot population in the steadiness and certainty of supplies. Consequently a steam press was set up by the Agricultural Department to turn out bales faster to keep pace with the demand. For two months, during April and May, baling with the hand and steam presses was pushed through vigorously in spite of forced interruption of work by heavy showers now and again.

When baling activities came to a close in the first week of June 1924, 320 tons of hay were baled out with the steam

press, 830 tons with the hand-presses of the Irani, Leslie, and Ladder type, eight of which were in working order throughout the season. Loose hay remaining over in the jungle at the site of collection was 850 tons. These figures include 25 per cent. driage and 5 per cent. wastage allowed at the final stage, in consideration of abnormal conditions of working.

The cost of steam-pressing worked out to Rs. 14 per ton and hand-pressing Rs. 6 per ton, inclusive of the cost of baling wire. The cost of collection was, on an average, Rs. 11 per ton and of transport to railheads with an average lead of 8 miles was Rs. 4. The cost of a ton of steam and hand-pressed bales, delivered on the rail was respectively Rs. 29 and Rs. 21 per ton. Freight charges were entirely borne by Government. Steam-pressed hay at destination cost Government nearly the same or even less than hand-pressed hay per ton, owing to saving in freight on steam-pressed bales as can be seen from what follows. An ordinary C. G. N. Wagon of the M. & S. M. Railway holds 65 steam-pressed bales of 80 lbs. each against 27 hand-pressed bales each of nearly the same average weight, and the volumes of the two different kinds of bales,—hand-pressed bales being $9\frac{1}{2}$ c.ft. and steam-pressed bales $4\frac{1}{4}$ c.ft. weight for weight—account for this packing. The freight for C. G. N. Wagon to the farthest and nearest destination stations was respectively Rs. 32 and Rs. 16.

In addition to the fodder grass, paddy straw from the channel area was also supplied to the affected localities. At first, fodder grass was very much disliked by the ryots as well as the cattle, but by and by the sale of the same increased owing to its comparative cheapness. Paddy straw sold at Rs. 1-6-0 and jungle grass at Rs. 1-2-0 per bale of 80 lbs.

Field work.—Collection and stacking was everywhere started departmentally as no contractors would come forward to undertake the work. Gradually some contractors were secured, but they all complained of heavy loss on account of driage, and backed out of their agreements.

The Range Officers were responsible for recruiting necessary labour. The gangs of coolies numbering from 30 to 40, which

consisted of 75 per cent. females and boys, were taken out by a Forester or a literate guard to the jungle and worked from 8 A.M. to 5 P.M. with a short interval at about 2 P.M. Grass on being cut, was made into bundles of uniform size which the Forester was required to weigh by means of a pocket spring balance to ensure that they were over 20 lbs. each. 7 to 9 such bundles were prepared by each coolie. When the working was systematised, collection was being done on piece work, each coolie earning as. 8 per day, having to give 8 bundles of grass of between 22 and 25 lbs. each which actually weighed only 19 or 20 lbs. by the time they reached the presses. Until proper arrangements were made for producing bundles of uniform size, trouble was felt at every stage of the work as can be seen from what follows. Cost of collection at the above rate of working reached a minimum of Rs. 8 per ton.

Carting.—45 such bundles of 20 lbs. to 22 lbs. wt. were loaded in a cart thus ensuring a full load for a cart in fairly open jungle tracks. Owing to the lateness of the season of collection, damage by fire and mixed patches of grass and undergrowth, really concentrated collection was not possible. This scattered cutting rendered cutting over long distances necessary in order to facilitate concentrated baling in chosen centres. Cost of carting came to Rs. 3 per ton taking an average lead of 4 miles along jungle tracks.

Baling.—Four of the jungle bundles were packed into a press—slightly more in the case of Irani presses. This measure ensured the uniformity of the weight of bales. It can thus be seen that the standardising of the jungle bundles rendered work in the succeeding stages more uniform, requiring less skilled supervision. Ties used were 16 guage copper wire cut to 8′ 10″ lengths. Four ties were necessary for one bale. To economise copper wire thin galvanised wire obtained from the Iron Works Stores at Bhadravati, were used in 3 strands for the 2 middle ties, the end ones being of copper wire for strength.

Rope ties were never resorted to, but when they were used to replace snapped wire ties at loading stations, they were found unsatisfactory. Bamboo slips and split cane would have been good substitutes but there was no time to secure them or to

train the coolies to use them either. The cost was Rs. 4 per ton for baling, not less than 3 presses being set up in one place Where any one or two of the presses got out of order, the cost of outturn rose as the same number of coolies could not be fully employed for working 2 presses and a smaller number could not be engaged without loss of efficiency.

Carting Bales.—Carting bales was a great difficulty as it never paid the cartman as well as timber carting. Hence the timber cartmen were indirectly forced to it by being allowed one trip with timber for every trip with bales. By practice, the cartmen loaded their carts better in the later stages getting 10—12 bales, instead of 8 or 9 as in the first trips. Much trouble was felt on account of the prejudice of the local coolies and cartman to go heart and soul into any new work other than the routine types of labour. It cost as. 2½ per bale on an average for transhipping one bale of 80—85 lbs. over 8 miles of metalled road. Loading into wagons at railheads was paid for at as. 12 to Re. 1 per truck according to the capacity of the wagon. In practice, it was found harder to load steam-pressed bales. In the case of hand-pressed ones indifferent packing did not matter, as there was always spare space at the top of waggon which could not in any way be filled up. Taken all together, it was undoubtedly cheaper to ship steam-pressed bales, though the cost of outturn was much higher; and, even that cost could be reduced by handling a larger quantity of loose hay than was actually possible in the course of a month and a half or two, with intermittent working, and out of season.

In the affected localities, the bales for sale were stored in depôts either under the control of the revenue authorities, usually the Amildars (Tashildars) or the Agricultural Inspectors of the several places. The bales were nearly always stacked in the open, but were fenced in to keep out stray cattle.

The money allotted by Government for the distress operations was Rs. 90,000. Taking only round figures the cost of collection and pressing together with incidental charges, was Rs. 32,000 and freight at concession rates, of part of the total collection only amounted to Rs. 18,000 reaching a total of

Rs. 50,000 besides the pay and allowances of the staff employed exclusively on this duty both from the Forest and the Agriculture Departments.

Comparing results with similar operations in the C. P. for the supply of hay to the Army in Mesopotamia during the years of war, on a much larger scale, it is easily noticed that the costs of collection and baling are higher in Mysore, as ought to be the case with limited working and to suit a changing programme. The lowest rate per ton of pressed hay in the C. P. is as low as Rs. 12 in North Chanda Division, and the highest rate is Rs. 25 per ton in Jabbalpur-Narsingapur Division, while everywhere in Mysore the rate could not be kept below Rs. 21. The reason for this big difference is to be found in the cheapness of labour in the C. P. generally on the one hand and on the other the lateness of the season of commencing fodder operations in Mysore, in addition to the incidental increase in cost of production when attempting to meet a big demand at short notice out of season. Damage by fire and cattle was not very great. As there was no work during nights, there was the less danger of fire from Kitson lights and torches, which would have to be in evidence for working in the dark.

Drying and cleaning of grass on cutting seems to be necessary and conducted on an elaborate scale in the C. P. In Mysore generally the winter temperature is not so low nor is the dew fall so heavy. Hence the system of drying on end or spread out in single layers left for a week under shade does not seem to be necessary. Elaborate combs for cleaning grass from dry leaves and undergrowth and needles in some varieties of grasses as those employed in the C. P., were not used, nor thought necessary with varieties of grass worked in Mysore, and on a limited scale.

In Bombay Presidency, the chief feature of the operation is the storage zinc-sheet sheds constructed at great cost, *e.g.*, West Kandesh. To provide against years of fodder scarcity, the Bombay Forest Department store baled fodder every year to the extent of 100—150 tons anually and clear out the accumulated stock of 600 tons every four years by auction sale, if the same be

not drawn upon for relief of distress during the period. In order to keep the bales fresh for 4 years the longest, complete protection from sun and rain is necessary. Hence zinc-sheet roofed sheds open on all sides with drains running round the raised flooring are built at great cost. One such was built at a cost of Rs. 7,000 in West Kandesh some two years ago as far the writer could gather.

A type of temporary storage shed that the writer saw in Poona Cantonment consisted of two grass tatties placed resting against each other at the top and on the ground at the bottom 50′ apart. The tatties were 50′ × 50′ and were partly supported by the steam-pressed bales which were built up in *prism* form inside and they lasted only one season. The particular stack visited contained about 40 tons of steam-pressed bales.

The rate of supply of paddy straw at Anantapur, one of the badly affected British Districts is Rs. 1-5-0 per bundle of 80 lbs. The hay was got from the Krishna District and distributed by the local revenue authorities. Paddy straw was transported in ordinary unpressed bundles so that freight charges per ton were enormous, which were nevertheless entirely borne by Government.

It is indicated from the above that the cost of outturn of baled fodder may greatly be reduced by :—

(1) Beginning cutting and collection early in November and completing the same before January ;

(2) Carting cut fodder for baling in one centre ;

(3) By running a battery of hand-presses in the same place ;

(4) By carrying on cutting, collection and baling operations for 3 or 4 months annually and storing them for years of drought.

Many other minor details of working, *e.g.* selection of site for pressing, method of storing bales, etc., to further economise labour, cannot be gone into in a paper of this nature, but every attention must be paid to them to avoid inconvenience in the later stages of working.

D. NARASIMHA MOORTY RAO.
Special Duty, Hay Collection,
Bhadravati.

HOT AIR

OR TIMBER SEASONING IN VARIOUS COUNTRIES.

Happy is the Seasoning man who is "located" in the United States of America. There he is not considered as a nuisance or fanatic, but as an asset, because by the practise of his art he converts so much lumber into hard cash, 18—12 or 6 months earlier than under *laissez faire* conditions.

He has of course to show that the interest and amortisation, on the installation outlay, and working costs are less than the saving on capital and that the material is not depreciated, but once this is proven, the necessary apparatus is provided and the output of the sawmill goes through the drying process and comes out ready for immediate sale.

I have never been in that delightful position, on the contrary, for 18 years I have been battling with English, French, Italian, Dutch, Austrian and Finnish peoples, to persuade them to ignore their climates, and speed up the turnover. The English merchant with a few exceptions, either sells American kilndried stock, or can afford to hold big stocks and wait. The French or Italian argues long and technically and either does nothing, or puts down a small plant with a lot of complications. The hard-headed Scandinavian aims to just dry the wood enough to reduce shipping weight and make the material saleable.

On the technical side, the timber expert made up his mind that artificial seasoning was "against nature" and that the timber was spoilt. As people were experimenting with little hot stoves, rather than pay for acquired experience, and spoiling wood, there where plenty of examples to back up this opinion.

In various countries varying arguments turned the balance. In France a pending penalty on a Balkan war contract influenced Schneiders to install rapid seasoning apparatus for gun-carriage timbers, and to their astonishment, they not only got the timber seasoned in time, but found that there were less rejections on the artificially seasoned timber than with air-seasoned (when they could get it). Austrian Jews found that a Dryer turned forests into money quickly, as in three weeks a standing tree was felled,

sawn, dried, planed, and shipped as finished parquet floor blocks. The North Europe saw mills were losing four or five months of the year. They could steam melt the river and get out the logs and they could rail the sawn timber to an ice free port, but they could not dry the boards by one per cent. with 50 to 60 degrees of frost, and they had a selling specification saying "guaranteed NOT kiln dried." However a properly proportioned apparatus was evolved, which removed 30 per cent. of the wet weight (reducing freight and liability to damage in transit) and by avoiding high humidity the outturn was 'bright' and no one with objection to artificial seasoning would ever dream of its having been through the hated process.

In England, the war brought on a crisis in aeroplane timber supplies, and when all air-seasoned stock was at an end Willy Weir put his foot down, against the advice of many a timber expert (Mr. A. L. Howard and Prof. Percy Groom were about the only two in favour)—and as a result some twenty million feet of timber were dried by rapid methods, with most unhappy results—to the Bosch.

Artificial seasoning is not a complicated process, but you cannot treat everything the same way. The species of timber has to be considered, and also the climate of the country. A process that has proved excellent for pine in Finland may be quite unsuccessful for hardwood in Italy, and Dryers evolved to meet American and English conditions, have to be considerably modified before they will meet Indian conditions and climate.

It is one thing to deal with the output of a saw mill in Finland or America, which is daily turning out 40 or 50 standards of soft wood, all in one or two thicknesses, and quite another to accommodate the mixed scantlings that make the output of a railway carriage works.

In India, there are such a multitude of presentable timbers—some that season easily and without cracking, others can be used unseasoned without penalty, but a large number are very refractory and deteriorate unless guarded from the effect of a hot dry atmosphere—that considerable research is necessary before the

best treatment can be best prescribed and the latter put in a usable form for the commercial user.

It is the possession of such amenable timber as Teak, Rosewood, Deodar, Sal (which last stays wet), etc., that has enabled India to jog along without worrying about seasoning processes, but increased demand and shorter supplies have caused the prices of these few species to go up, and so other timbers are being considered now by important users.

These newly exploited timbers are presentable in appearance or structurally strong, according to their class, but they many of them decline to part with their moisture in the amenable way that Teak and Rosewood behave, but season slowly or split badly. Some others would be useful if they were not so depreciated by fungus during slow seasoning.

In order to bring these into use, artificial seasoning is being tried and is showing excellent results. Some of the worst splitters come out of the Dryer without noticeable degrade, and in two or three weeks' time only, instead of taking 18 months or more. Incipient fungus wilts under the well ventilated high temperature conditions. This saving in time means interest on capital. Elimination or reduction of degrade for fungus stain means better quality and better price. But the most valuable use of rapid seasoning is that fresh timbers can be quickly brought into common use, and introduced to commercial users in a properly seasoned and attractive state, and without fear of subsequent troubles.

Artificial seasoning should rather be called 'accelerated' seasoning, it is not unnatural but follows the lines of open air seasoning under ideal conditions. Hot Air is used to extract and carry away the moisture, but its temperature is graduated from atmospheric temperature at the start, up to temperature of direct sun heat when nearing dryness. It is retarded by control of the humidity so as not to dry the exterior in advance of the interior, which would cause uneven contraction and splits; this can be compared to rains humidity. In other words you start with July (warm and humid) carry on with October (medium

temperature and humidity) and finish up with May (hot and dry) eliminating night cooling, and maintaining a steady ventilating wind all the time.

Different species require different variations of these conditions, that is some can go faster than others, but the experiments made up to the present on the lesser used Indian timbers, show that these can be seasoned in a very short time, and at reasonable cost, and without appreciable deterioration.

STANLEY FITZGERALD.

SOME NOTES AND PROBLEMS OF THE CENTRAL PROVINCES TEAK AREAS.

At the present time in the C. P. practically all the working plans are either old or old-fashioned. By old-fashioned I mean that they were written at a time when the writers were under the gloom that shadowed C. P. forestry; at a time when the writers had no hope that money would be available for any work except that of a revenue-getting nature. Hence they did not prescribe any silvicultural work except possibly Cutting Back Operations, which meant that second and third class species were cut back when they were likely to suppress the coppice from a teak stool, or when they were suppressing seedlings of the more valuable species. I expect that in most cases when these were prescribed it was only a faint, wild, and pious hope on the part of the writer.

But we now seem to be at the dawn of a better day for C. P. forestry. The powers-that-be are very keen on all works of improvement such as freeing teak seedlings, and especially thinnings, which are so urgently needed in the better class teak areas, that it is difficult to know where to start. What is more than mere keenness, we seem to be able to get at least some money for this work. Yet it is rather difficult to work at present owing to the fact, that an officer, when carrying out any operation, does not know what he is working for except that he is trying to increase the number of first class species in the forest. Therefore new working plans must be drawn up to suit the new and more hygenic fashions,

At the Conservators' Conference in 1922 a long list was drawn up of divisions in which working plan work should be started—a list that by no means included all the plans that were desirable, but only those which were very urgently required. In spite of this I believe that the only plans which have been completed are those of North Mandla and South Raipur. A few efforts have been made in other divisions, but these have since been given up owing to the reasons which follow.

At the present time the forest officers of the C. P. are either pre-war officers who are urgently required as Divisional Forest Officers for the more important charges, or they are post-war officers. It would appear, therefore that the whole thing is a matter of Hobson's choice and that the post-war officers would be put on to do the working plan work ; but this is not the case, for the powers who are above the mere professional forest officer, while seeming to have confidence in the post-war officer as far as forestry is concerned, consider that he is not competent to cater for the local requirements of the people. As however under the rules in the C. P. Forest Manual a Revenue Officer is supposed to be attached to the Working Plan Officer for this purpose, it is rather difficult to see what the real reason is; perhaps it is a question finding a competent revenue officer.

This then is the first great thing which is keeping back C. P. forestry. It would be impertinence on my part were I to enumerate the many things which make a working plan essential, as these have been manifest to most forest officers since lack of forestry caused denudation and the Flood.

The second problem that has to be met in the C. P. was realised by Napoleon when he classed distance (=area) as the greatest military obstacle. I once heard it said that the C. P. forest officer used his 'area' as a shield with which to hide poor or unscientific work. I would mention that one of the best C. P. divisions has been calculated to be equal in size to sixty German Forest Divisions (the simile is not quite fair, but there is a little difference between the German staff and ours). I do not know the area of the average coupe in a Felling Series but am acquainted

with one coupe of 4,000 acres in area. This will illustrate the fact that the C. P. 'area' is not a shield but a reason.

It is quite impossible to get much done with the whole area of reserved forest in the C. P., nor would it be an economical proposition as a big proportion of the area in many divisions is very poor, either owing to the grazing difficulty or owing to the extreme poverty of the factors of the locality, or both.

At the present time there seems to be a rooted objection against having either a Working Circle or a Felling Series in the form of anything but a solid block. Owing to the way in which the type of forest varies from place to place, as long as this prejudice continues, so long will the lot of the Working Plan Officer be unhappy. The better class areas of not less than 300—400 acres, which contain a good proportion of teak, could be picked out and put into a single Working Circle, and unless there is more than one market no Felling Series are required, it is immaterial as to how many coupes are allotted for working each year, provided that they are sufficiently far apart to provide labour and grazing difficulties. Thus all the best class of area in each division would be separated out, and it would be possible to concentrate effort on this area. The remaining area would have to be worked much as it has been worked, or better still not worked until the predicted timber famine arrives, or a brighter day dawns which will make its scientific working possible. Thus in a sense the area difficulty will be reduced.

At the present this in nearly all the old plans for all types of area, either the Coppice with Standards System or the Improvement Fellings System is prescribed.

The name Coppice with Standards appears to be a misnomer, as I have known 60 standards per acre prescribed, this I think gives a standard about every twelve yards, and if these average about middle aged it would be more like high forest than Coppice with Standards. It is quite a nice system to mark under, as one can in practice mark as many trees as one wishes, and get rid of the many poles which are saleable as poles and not as trees (*i.e.*, *Dhaura*). However in the hands of the lesser trained of the

subordinates it is rather a poor system, as they think that they must adhere to the prescribed number of standards and so either reserve rubbish or fail to reserve some of the better class trees which should be reserved. The system at its best is of a slightly improving nature, at its worst it is not a silvicultural system.

Under the Improvement Felling System all the better class trees which are likely to improve during the course of the next Felling Cycle are kept in the crop, the others are marked for felling. Hence in actual practice the two systems come to much the same thing, except under one the trees that are for felling are marked, and under the other system the trees for reservation are marked, hardly a matter of silviculture. The Improvement Fellings System has the disadvantage that it is impossible to get rid of saleable inferior poles without copious marking.

Both systems require really good Cutting Back Operations if they are to be of any use. But in the past usually the money allotted, for even good areas, was a mere drop in the ocean. Under these circumstances the systems became thinnings among the teak to favour the inferior species. Both systems are fairly satisfactory when well backed up by good silvicultural operations.

Neither system is good enough for the better class teak areas, as it is difficult to reconcile the idea of using any uneven-aged system when the most important species are light demanders; this surely is one of the cardinal points of scientific forestry. Further it seems that the more light, air, and sun teak seed gets the more likely is regeneration to take place; this may be the reason for the terrible lack of regeneration by seed in some forests under these systems; in such cases the systems fail to do more than keep the percentage of the superior species at a constant.

It would appear, therefore, that the next great problem is to find a satisfactory even-aged system for the better type C. P. teak forest. There seem to be three possibilities: the taungya, clear-coppice, and a form of the Uniform Compartment System.

In most areas it is very doubtful whether the taungya system would be of use as the soil is usually poor, and the ground often rocky and hilly.

In some divisions the clear coppice system is being tried, and I rather fail to see the objection to it, provided it is backed by the cutting back of all species which the contractor does not remove. In the case of teak in areas where there is little danger from frost, the necesssity for mother trees is not marked, as the seed and seedling seem to do best in the open, and when a crop is removed the ground must be full of ungerminated seed, and even if the seedlings of one year are all killed there will be plenty of seed still about to germinate, for the seed will not all germinate in one year. There remains the Uniform System, and this is likely to be more palatable than the foregoing system, and may very likely be the solution of the problem, yet I doubt if it is superior to clear coppice.

It will be interesting to see when a start will be made with an even-aged system, if at all. At various schools of forestry one spends time trying to devise schemes to bring about some change in the forest for the least loss in revenue. If the even-aged system comes in it will be of interest to see whether the Working Plan Officer will make a plunge for the even-aged system or whether he will prescribe a modification of the two old systems to bring the forest into a more even-aged state, so that the even-aged system may be brought in at the end of the felling-cycle for which the plan is drawn up. I am doubtful whether this latter course would save as much as would appear at first sight, it is true that many undermature trees would be felled if the even-aged system should be brought in at once, but, on the other hand, when once the coupe was regenerated there would be a great increase in increment, as under an uneven-aged system nearly every tree of a light demanding species suffers from partial suppression during a large portion of its life.

It is very hard if the Working Plan Officer is asked to prescribe a system under the present conditions, as he cannot be expected to be certain as to whether one of the even-aged systems is likely to suit the division for which he is expected to prescribe. His work would be lightened if experimental plots were taken up in average good class teak areas in each division, which is likely to require a new Working Plan within the next fifteen

years. In these plots experiments could be carried out with the silvicultural systems for even-aged forest, which may appear to offer hopes of success in the locality for which the working plan is to be made.

In conclusion I wish to make it clear that the foregoing remarks cannot 'crab' the work of the forest officers of the past, as one has only to see the results to realise what wonderful work was done by them in spite of the hopelessly uphill game they had to play, and the difficult conditions owing to lack of staff and money. Lastly, I would express a faint hope that the old saying about grand-mothers and eggs will not be applied to me.

P.

NEW INDIAN SPECIES OF FOREST IMPORTANCE.
PART 6.

[*Continued from* Indian Forester, *Vol. XLVIII* (1922), *pp.* 247—258].

The present list includes 197 species and, as 550 species have already been enumerated in the previous lists, the total comes up to 747 species.

A list of 14 species omitted by oversight from the Index Kewensis has been given separately.

Many names which are invalid under the International Rules have recently appeared in Indian Floras, particularly in Mr. Gamble's Flora of Madras. It has been considered preferable to show these separately rather than to omit them altogether.

1. **Abutilon molle,** Sweet, *Malvaceæ* (Parker's For Fl., Punjab (1918), p. 39), Nat. in Lahore and Saharanpore—Peru.

Acacia dealbata, Link, *Leguminosæ* (Troup's Sylv. Ind. Trees, Vol. II (1921), p. 464), Nat. in Nilgiris and Palni Hills, New South Wales, Victoria, etc.

Acacia hydaspica, J. R. Drummond, Mss. ex Parker, *Leguminosæ* (Kew Bull., 1921, p. 309), N.-W. India Peshawar to Jhelum, Salt Range.

Acacia pseudo-eburnea, J. R. Drummond ex Dunn *Leguminosæ*, (l. c., 1922, p. 185), N.-W. India, Kumaon.

5. **Acer Wardii**, W. W. Smith, *Sapindaceæ* (Notes, Roy. Bot. Gard., Edin., Vol. X (1917), p. 8), Upper Burma.

Aeschynanthus sikkimensis, Stapf, *Gesneraceæ* (Curtis, Bot. Mag. (1922), t. 8938), Sikkim, Bootan, Khasi Hills.

Agapetes Wardii, W. W. Smith, *Vacciniaceæ* (Notes, Roy. Bot. Gard., Edin., Vol. VIII (1915), p. 330), Upper Burma.

Agrostistachys Meeboldii, Pax & Hoffm. *Euphorbiaceæ* (Das Pflanzenreich, Heft 57 (1912), p. 100), Ind. or (Malabar, Travancore).

Allamanda Cathartica, L., *Apocynaceæ* Gamble's Mad. Fl. (1923), p. 821), Nat. in Travancore, S. America.

10. **Alseodaphne Owdeni**, Parker, *Lauraceæ* (Ind. For., 1924, p. 365), Cachar Hills, Assam.

Andrographis Lawsoni, Gamble, *Acanthaceæ* (Kew Bull., 1923, p. 375), S. India.

Anisochilus argenteus, Gamble, *Labiatæ* (l. c., 1924, p. 265), S. India.

Antidesma gymnogyne, Pax. et Hoffm. *Euphorbiaceæ*, (Das Pflanzenreich, Heft 81 (1922), p. 135), Tenasserim.

A. rotatum, Muell. Arg., *Euphorbiaceæ* (l. c., p. 117) Burma.

15. **A. Walkeri**, Pax. et Hoffm. *Euphorbiaceæ* (l. c., p. 118), Ceylon.

Aporosa frutescens, Blume, *Euphorbiaceæ* (l. c., p. 91), Burma.

A. Duthieana, King Mss., *Euphorbiaceæ* (Das Pflanzenreich, Heft 81 (1922), p. 99), Burma, Mergui.

A. ficifolia, Baill. *Euphorbiaceæ* (l. c., p. 94), Tenasserim, Tavoy.

A. obovata, Pax et Hoffm. *Euphorbiaceæ* (l. c., p. 100), Mergui.

20. Asclepias physocarpa, Schlect. *Asclepiadaceæ* (Gamble's Mad Fl. (1923), p. 833), Nat. in the Nilgiris. South Africa.

Astragalus aegacanthoides, Parker, *Leguminosace* (Ind. For., 1923, p. 78), Kumaon.

Bauhinia rufescens, Lamk., *Leguminosæ* (Gamble's Mad. Fl. (1919), p 409), Naturalised near Madras. Trop. Africa.

Berberis favosa, W. W. Smith, *Berberideæ* (Notes, Roy. Bot. Gard. Edin., Vol. XI (1919), p. 200), Upper Burma.

B. Lamberti, Parker, *Berberideæ* (Kew Bull., 1921, p. 307), N.-W. Himalaya, Almora.

25. Buddleia Cooperi, W. W. Smith, *Loganiaceæ* (Notes, Roy. Bot. Gard., Edin., Vol. X. (1917), p. 14), Bhutan.

Capparis auricans, Craib, *Capparidaceæ* (Kew Bull., 1922, p. 169) Burma.

Carissa salicina, Lamk. *Apocynaceæ* (Encycl. 1, p. 554), S. India.

Cassiope myosuroides, W. W. Smith, *Ericaceæ* (Notes, Roy. Bot. Gard., Edin., Vol. X (1917), p. 19), Upper Burma.

Cleistanthus Meeboldii, Jabl. *Euphorbiaceæ* (Das Pflanzenreich, Heft 65 (1915), p. 20), Mergui, Tenasserim.

30. C. travancorensis, Jabl., *Euphorbiaceæ* (l. c., p., 21), Travancore.

Cornulaca monocantha, Del. *Chenopodiaceæ* (Boiss Fl., Or. IV, 984; Jour. Asiat. Soc., Beng., XV (1919), p. 285), Afghanistan.

Crotalaria Brownei, Bertero, *Leguminosæ* (Jour. Asiat. Soc., LXVI, pt. II (1897), p. 353), Nat. in Chittagong, West Indies.

Daedalacanthus Wardii, W. W. Smith, *Acanthaceæ* (Notes, Roy. Bot. Gard., Edin., Vol. X (1918), p. 174), Upper Burma.

Datura suaveolens, Humb. and Bonpl., *Solanaceæ* (Rec. Bot. Surv., India, Vol. VI (1921), p. 411), Nat. in India, Mexico.

Diospyros Holeana, Gupta and Kanjilal, *Ebenaceæ* (Ind. For., 1924, p. 255), Nepal border, Gonda Division.

Ellipeia costata, King, *Anonaceæ* (Jour. Asiat. Soc., Beng., Vol. LXI, pt. II (1892), p. 26), Burma.

Eranthemum tapingense, W. W. Smith, *Acanthaceæ* (Notes, Roy. Bot. Gard., Edin., Vol. X (1918), p. 177), Burma.

Euonymus Wardii, W. W. Smith, *Celastraceæ* (Notes, Roy. Bot. Gard., Edin., Vol. X (1917), p. 37), Burma.

Fraxinus Brandisii, Lingelsh *Oleaceæ*, (Das Pflanzenreich, Heft. 72 (1920), p. 56), N.-W. Himalaya, Pangi, Mussoorie.

Gymnosporia Championi, Dunn, *Celastraceæ* (Kew Bull., 1921, p. 308), United Provinces, Ramnagar Division.

Hydrangea subferruginea, W. W. Smith, *Saxifragaceæ* (Notes, Roy. Bot. Gard., Edin., Vol. XI (1919), p. 212), Upper Burma.

Impatiens cochinica, Hk. f., *Geraniaceæ* (Kew Bull., 1911, p. 355), Cochin.

I. macrocarpa, Hk. f., *Geraniaceæ* (l. c., p. 355), Travancore.

Indigofera Anil, L., *Leguminosæ* (Jour. Asiat Soc., Beng., LXVI (1897), p. 356), Nat. in Burma and the Andamans, S. America.

45. **I. Howellii,** Craib et W. W. Smith, *Leguminosæ* (Notes, Roy. Bot. Gard, Edin., XII (1920), p. 207), Upper Burma.

I. rubro-violacea, Dunn, *Leguminosæ* (Kew Bull., 1922, p. 117), Chamba State, Kashmir.

Jasminum strictum, Haines, *Oleaceæ* (Kew Bull., 1921, p. 310), Plateau of Chota Nagpur.

Lepidagathis Barberi, Gamble, *Acanthaceæ* (l c., 1923, p. 375), S. India.

Leptodermis kumaonensis, Parker, *Rubiaceæ* (Ind. For., 1922, p. 576), Kumaon.

50. **L. riparia,** Parker, *Rubiaceæ* (l. c., 1924, p. 398), Kumaon

Lysionotus gracilis, W. W. Smith, *Gesneraceæ* (Notes, Roy. Bot. Gard., Edin., Vol. X (1918), p. 186), Upper Burma.

L. Wardii, W. W. Smith, *Gesneraceæ* (l. c., p. 186), Upper Burma.

Machilus robusta, W. W. Smith, *Lauraceæ* (l. c., Vol. XIII (1921), p. 169), Upper Burma.

Magnolia rostrata, W. W. Smith, *Magnoliaceæ* (l. c., Vol. XII (1920), p. 213), Upper Burma, Bhamo.

55. **Mahonia acanthifolia,** G. Don. *Berberidaceæ* (Gen. Syst, Vol. I (1831), p. 118), Nepal, Kumaon, Assam, Darjeeling.

M. borealis, Takeda, *Berberidaceæ* (Notes, Roy. Bot. Gard., Edin, Vol. VI (1917), p. 221), N.-W. India.

M. Griffithii, Takeda, *Berberidaceæ* (l. c., p. 217), Bhutan.

M. Leschenaultii, (Wall.) Takeda, *Berberidaceæ* (l. c., p 223), Nilgiris, Anamallaya Hills; Ootacamund.

M. manipurensis, Takeda, *Berberidaceæ* (Notes, Roy., Bot. Gard., Edin., Vol. VI (1917), p. 222), Manipur.

60. **M. pycnophylla,** (Fedde) Takeda, *Berberidaceæ* (l. c., p. 218), Khasya.

M. Roxburghii, D. C.) Takeda, *Berberidaceæ* (l. c., p. 218), Manipur.

M. sikkimensis, Takeda, *Berberidaceæ* (l. c., p. 200), Sikkim.

M. Simonsii, Takeda, *Berberidaceæ* (l. c., p. 222), Khasya Hills.

Mallotus intercedens, Pax et Hoffm. *Euphorbiaceæ*, (Das Pflanzenreich, Heft. 63 (1914), p. 179, Malabar.

65. **M. pachypodus,** Pax et Hoffm., *Euphorbiaceæ* (l. c., p. 196), Burma.

M. tristis, Pax et Hoffm., *Euphorbiaceæ* (l. c., p. 154), Burma.

Michelia Lacei, W. W. Smith, *Magnoliaceæ*, (Notes, Roy. Bot. Gard., Edin., Vol. XII (1920), p. 216), Upper Burma.

Moringa amara, Durin, *Moringeæ* (Rev. Gen. Bot., XXV (1913), p. 469, in Obs.), Ind. Or.

Mycetia gracilis, Craib., *Rubiaceæ* (Kew Bull., 1914, p. 125), Burma.

70. **Neohouzeaua,** A. Camus, Gen. Nov. *Bambuseæ* (Bull. Mus. Nat. d'Hist. Natur. (1922), p. 100).

N. Helferi, Gamble, *Bambuseæ* (Kew Bull., 1923, p. 91), Burma, Assam.

N. tavoyana, Gamble, *Bambuseæ* (l. c., 1923, p. 92), Burma.

Orophea salicifolia, Hutchinson, *Anonaceæ* (l. c., p. 371), Andaman Islands.

O. torulosa, *Anonaceæ*, (l. c., p. 115), Andaman Islands.

75. **Osbeckia septemnervia,** Ham. Mss. in Herb., Edin. ex Craib, *Melastomaceæ* (Notes, Roy. Bot Gard., Edin., Vol. X (1917), p. 55), Himalaya, Gaulpara.

O. sikkimensis, Craib, *Melastomaceæ* (l. c., p. 56), Himalaya, Sikkim, Darjeeling.

O. Wattii, Craib *Melastomaceæ* (l. c., p. 57), Naga Hills.

Oxyspora serrata, Diels, *Melastomaceæ* (Notes, Roy. Bot. Gard., Edin., V (1912), p. 252), Burma.

Pandanus Wallichianus, Martelli, *Pandanaceæ*, (Webbia IV (1914), p. 435), Burma.

80. Parastyrax, W. W. Smith, Gen. Nov., *Styraceæ* (Notes, Roy. Bot. Gard., Edin., Vol. XII (1920), p. 231).

P. burmanicus, W. W. Smith, et Farrer, *Styraceæ* (l. c., p. 233), East Upper Burma.

Pelargonium graveolens, Aiton, *Geraniaceæ* (Fyson's Fl., Nilgiris & Pulney Hill tops (1915), p. 54), Nat. in Nilgiris, S. Africa.

Piper aurorubrum, C. DC., *Piperaceæ* (Fedde. Repert, X (1912), p. 519), Ind. Or., Manipur.

P. crenulatibracteum, C. DC., *Piperaceæ* (l. c., p. 521), Ind. Or., Kanara.

85. P. kapruanum, C. DC., *Piperaceæ* (l. c., p. 519), Ind. Or., Manipur.

P. lainatakanum, C. DC., *Piperaceæ* (l. c., p. 519), Ind. Or., Manipur.

P. Meeboldii, C. DC., *Piperaceæ* (l. c., p. 521), Ind. Or., Manipur.

P. magaense, C. DC., *Piperaceæ* (l. c., p. 520), Ind. Or., Manipur.

P. phalangense, C. DC., *Piperaceæ* (l. c., p. 518), Ind. Or., Manipur.

90. P. Talbotii, C. D.C., *Piperaceæ* (l. c., p. 523), Ind. Or., Bombay.

Plectranthus Bishopianus, Gamble, *Labiatæ* (Kew Bull., 1924, p. 265), S. India.

P. Bourneæ, Gamble, *Labiatæ* (l. c., p. 264), S. India.

P. Meeboldii, W. W. Smith, *Labiatæ* (Rec. Bot. Surv., India, VI (1914), p. 39) Burma.

Pleurospermum amabile, Craib & W. W. Smith, *Umbelliferæ* (Trans. Bot. Soc., Edin., XXVI (1913), p. 154), Himalaya.

95. Premna calycina, Haines, *Verbenaceæ* (Kew Bull., 1922, p. 122), Bengal, Bihar and Orissa and the Central Provinces.

Prosopis glandulosa, Torr, *Leguminosæ* (Ind. For. Records, Vol. IV (1913), p. 20), Nat. in the Punjab and Sind, S. United States and N. Mexico.

Prunus afghana, Cord. *Rosaceæ* (Nat. Syst., Vol. IV (1920), p. 32), Afghanistan.

P. trichantha, Kœhne, *Rosaceæ* (Sargent's Pl. Wilson, I (1913), p. 254), Ind. Or., Sikkim.

Pygeum anomalum, Kœhne, *Rosaceæ* (Engl. Jahrb. LI (1913), p. 183), Burma, Tenasserim.

100. P. ciliatum, Kœhne, *Rosaceæ* (l. c., p. 184), Assam.

P. ocellatum, Kœhne, *Rosaceæ* (l. c, p. 184), Assam.

Pyrus bhutanica, W. W. Smith, *Rosaceæ* (Rec. Bot. Surv., India, IV (1911), p. 265), Tibet and Bhutan, Himalaya.

Rauwolfia canescens, L. *Apocyanaceæ* Gamble's Mad. Fl. (1923), p. 808, Nat. in S. India, W. Indies.

Rhamnus cachemirica, Gandoger, *Rhamnaceæ* (Bull. Soc. Bot. France, LX (1913), p. 458), Kashmir.

105. Rhododendron æmulorum, Balf. f., *Ericaceæ* (Notes, Roy. Bot. Gard., Edin., Vol. XII (1920), p. 86), N.-E. Upper Burma.

R. agapetum, Balf. f. et Ward, *Ericaceæ* (l. c., Vol. XI (1919), p. 212), E. Upper Burma.

R. aiolosalpinx, Balf. f. et Farrer, *Ericaceæ* (l. c., Vol. XIII (1922), p. 227), N. E. Upper Burma.

R. aperantum, Balf. f. et Ward, *Ericaceæ* (l. c, p. 231), N. E. Burma.

R. argipeplum, Balf. f. et Cooper, *Ericaceæ* (l. c., p. 231), Bhutan.

110. R. arizelum, Balf. f. et Forrest, *Ericaceæ* (Vol. XII (1920), p. 90), N. E. Upper Burma.

R. brachystylum, Balf. f. et. Ward, *Ericaceæ* (l. c., Vol. XIII (1922), p. 236), N. E. Burma.

R. brevitubum, Balf. f. et Cooper, *Ericaceæ* (l. c., Vol. X (1917), p. 88), Bhutan.

R. calostrotum, Balf. f. et Ward, *Ericaceæ* (l. c., Vol. XIII (1920), p. 35), N. E. Upper Burma.

R. caloxanthum, Balf. f. et Farrer, *Ericaceæ*, (l. c., Vol. XIII (1922), p. 238 , N. E. Upper Burma.

115. R. cerinum, Balf. f. et Farrer, *Ericaceæ* (l. c., p. 240), N. E. Upper Burma.

R. charidotes, Balf. f. et Farrer, *Ericaceæ* (l. c., p. 242), N. E Upper Burma.

R. charitopes Balf. f. et Farrer, *Ericaceæ* (l. c., p. 243), N. E. Upper Burma.

R. charitostreptum, Balf. f. et Ward, *Ericaceæ* (l. c., p. 244), N. E. Upper Burma.

R. charopoeum, Balf. f. et Farrer, *Ericaceæ*, (l. c., p. 245), N. E. Burma.

120. R. chawchiense, Balf. f. et Farrer, *Ericaceæ* (l. c., p. 247), N. E. Upper Burma.

R. coelicum, Balf. f. et Farrer, *Ericaceæ* (l. c., p 250), N. E. Upper Burma.

R. commodum, Balf. f. et Forrest, *Ericaceæ* (l. c., p. 252), N. E. Upper Burma.

R. Cooperi, Balf. f. *Ericaceæ* (l. c., Vol. X (1917), p. 91), Bhutan.

R. cremnastes, Balf. f. et Farrer, *Ericaceæ* (l. c., Vol XIII (1922), p. 253), N. E. Upper Burma.

125. **R. Cubittii**, Hutchinson, *Ericaceæ* (l. c., Vol. XII (1919) p. 78), North Burma.

R. euchroum, Balf. f. et Ward, *Ericaceæ* (l. c, Vol. IX (1916), p. 228), E. Upper Burma.

R. dendricola, Hutchinson, *Ericaceæ* (l. c., Vol. XII (1919), p. 60), N. Burma.

R. epapillatum, Balf. f. et Cooper, *Ericaceæ* (l. c., Vol. XIII (1922), p. 257), Bhutan.

R. facetum, Balf. f. et Ward, *Ericaceæ* (l. c., Vol. X (1917), p. 104), E. Burma.

130. **R. haemonicum**, Balf. f. et Cooper, *Ericaceæ* (l. c., Vol. IX (1916), p. 233), Bhutan.

R. heptamerum, Balf. f. *Ericaceæ* (l. c., Vol. XIII (1920) p. 48), N. E. Upper Burma.

R. herpesticum, Balf. f. et Ward, *Ericaceæ* (l. c., Vol. X (1917), p. 114), E. Upper Burma.

R. hylæum, Balf. f. et Farrer, *Ericaceæ* (l. c., Vol. XIII (1922), p. 265), E. Upper Burma.

R hypenanthum, Balf. f *Ericaceæ* (l. c., Vol. IX (1916) p. 291) Himalaya.

135. **R. hypolepidotum**, Balf. f. et Forrest, *Ericaceæ* (l. c. Vol. XIII (1922), p. 266), E. Upper Burma.

R. jenestierianum, G. Forrest, *Ericaceæ* (l. c., Vol. XII (1920), p. 122), N. E. Upper Burma.

R. Kyawi, Lace et W. W. Smith, *Ericaceæ* (l. c., Vol. VIII (1914), p. 216), Burma.

R. lithophilum, Balf. f. et Ward, *Ericaceæ* (l. c., Vol. XIII (1922), p. 275), N. E. Burma.

R. Macabeeanum, Watt, Mss., *Ericaceæ* (l. c., Vol. XII (1920), p. 128), Manipur, Naga Hills.

140. R. Mackenzianum, G. Forrest, *Ericaceæ* (l. c., p. 132), N. E. Burma.

R. mallotum, Balf. f. et Ward, *Ericaceæ* (l. c., Vol. X (1917), p. 118), E. Upper Burma.

R. manipurense, Balf. f. et Watt, *Ericaceæ* (l. c., p 119), Manipur.

R. megacalyx, Balf. f. et Ward, *Ericaceæ* (l. c., Vol. IX (1916), p. 246), E. Upper Burma.

R. myrtilloides, Balf. f. et Ward, *Ericaceæ* (l. c., Vol. XIII (1922), p. 276), N. E. Burma.

1 5 R. niphobolum, Balf. f. et Farrer, *Ericaceæ* (l. c., p. 277) E. Burma.

R. nwaicense, Balf. f. et Ward, *Ericaceæ* (l. c., Vol. IX, (1916), p. 252), E. Upper Burma.

R. ombrochares, Balf. f. et Ward, *Ericaceæ* (l. c., Vol. XIII (1922), p. 280), N. E. Upper Burma.

R. oparinum, Balf. f. et Ward, *Ericaceæ* (l. c., Vol. X (1917), p. 129), E. Upper Burma.

R. oulotrichum, Balf. f. et Forrest, *Ericaceæ* (l. c., Vol. XIII (1922), p. 281), N. E. Upper Burma.

150. R. papillatum, Balf. f. et Cooper, *Ericaceæ* (l. c., p. 282) Bhutan.

R. phaedropum, Balf. f. et Farrer, *Ericaceæ* (l. c., p. 283), N. E. Upper Burma.

R. phoenicodum, Balf. f. et Farrer, *Ericaceæ* (l. c., p. 285), N. E. Upper Burma.

R. polyandrum, Hutchinson, *Ericaceæ* (l. c., Vol. XII (1919), p. 25), Bhutan.

R. preptum, Balf. f. et Forrest, *Ericaceæ* (l. c., Vol. XII (1920), p. 149), N. E. Upper Burma.

155. R. prophantum, Balf. f. et Forrest, *Ericaceæ* (l. c., Vol. XIII (1922), p. 58), N. E. Upper Burma.

R. regale, Balf. f. et Ward, *Ericaceæ* (l. c., Vol. XII (1920), p. 156), N. E. Upper Burma.

R. rhabdotum, Balf. f. et Cooper, *Ericaceæ* (l. c., Vol. X (1917), p. 141), Bhutan.

R. sciaphilum, Balf. f. et Ward, *Ericaceæ* (l. c., p. 146), E. Burma.

R. scyphocalyx, Balf. f. et Forrest, *Ericaceæ* (l. c., Vol. XIII (1922), p. 291), N. E. Upper Burma.

160. R. siolereum, Balf. f. *Ericaceæ* (l. c., Vol. XII (1920), p. 162), N. E. Burma.

R. sperabile, Balf. f. et Farrer, *Ericaceæ* (l. c., Vol. XIII (1922), p. 297), N. E. Upper Burma.

R. spilotum, Balf. f. et Farrer, *Ericaceæ* (l. c., p. 298) N. E. Upper Burma.

R. spodopeplum, Balf. f. et Farrer, *Ericaceæ* (l. c., p, 299), N. E. Burma.

R. tapeinum, Balf. f. et Farrer, *Ericaceæ* (l. c., Vol. XII (1920), p. 164), N. E. Upper Burma.

165. R. tephropeplum, Balf. f. et Farrer, *Ericaceæ* (l. c., Vol. XIII (1922), p. 302), N. E. Upper Burma.

R. thyodocum, Balf. f. et Farrer, *Ericaceæ* (l. c., Vol. XI (1919), p. 148), Bhutan.

R. torquatum, Balf. f. et Farrer, *Ericaceæ* (l. c., Vol. XIII (1922), p. 303), N. E. Upper Burma.

R. zaleucum, Balf. f. et W. W. Smith, *Ericaceæ* (l. c. Vol. X (1917), p. 163), E. Upper Burma.

Rubus almorensis, Dunn, *Rosaceæ* (Kew Bull., 1921, p. 310), United Provinces; Almora.

170. R. potentilloides, W. F. Evans, *Rosaceæ* (Notes, Roy. Bot. Gard., Edin., Vol. XIII (1921), p. 179), Upper Burma.

Sabia Wardii, W. W. Smith, *Sabiaceæ* (l. c., Vol. X. (1917), p. 64), N. Burma.

Sambucus Hookeri, Rehder, *Caprifoliaceæ* (Sargent Pl. Wilson, I (1913), p. 308), Ind. Or. Sikkim.

Sauropus concinnus, Coll. et Hemsl. *Euphorbiaceæ* (Das Pflanzenreich, Heft 81 (1922), p. 224), Upper Burma.

Skimmia melanocarpa, Rehder and Wilson, *Rutaceæ* (Sargent Pl. Wilson II (1914), p. 138), Sikkim.

175. **Solanum sisymbriifolium**, Lamk. *Solanaceæ* (Gamble's Mad. Fl. (1923), p. 938). Nat. in many parts of India, S. America.

S. robustum, Wendl. *Solanaceæ* (l. c., p. 938), Nat. in Nilgiris, S. America.

Sorbus arachnoidea, Kœhne, *Rosaceæ* (Fedde Repert X (1912), p. 154), Sikkim.

S. Wattii, Kœhne, *Rosaceæ* (l. c., p. 515), Burma.

Spiraea diversifolia, Dunn, *Rosaceæ* (Kew Bull., 1921, p. 309), United Provinces, East Almora.

180 **S. Wardii**, W. W. Smith, *Rosaceæ* (Notes, Roy. Bot. Gard., Edin., Vol. X (1917), p. 68), Upper Burma.

Sporoxeia, W. W. Smith, Gen. Nov., *Melastomaceæ* (l. c., Vol. X (1917), p. 69).

S. sciadophila, W. W. Smith, *Melastomaceæ* (l. c., p. 70), Upper Burma.

Stereospermum angustifolium, Haines, *Bignoniaceæ*, (Kew Bull. (1922), p. 121), Central Provinces, Angul Sambalpur.

Strobilanthes arenicolus, W. W. Smith, *Acanthaceæ*, (Notes, Roy. Bot. Gard., Edin., Vol. X (1918), p. 190), Upper Burma.

185. **S. circarensis**, Gamble, *Acanthaceæ* (Kew Bull., 1923 p. 323), S. India.

S. Lawsoni, Gamble, *Acanthaceæ* (l. c., p. 374), S. India.

S. oresbius, W. W. Smith, *Acanthaceæ* Notes, Roy. Bot. Gard., Edin., Vol. X (1918), p. 196), Upper Burma.

S. stramineus, W. W. Smith, *Acanthaceæ* (l. c., p. 200), Upper Burma.

S. urceolaris, Gamble, *Acanthaceæ* (Kew Bull., 1923, p. 374), S. India.

190. **S. Wardii**, W. W. Smith, *Acanthaceæ* (Notes, Roy. Bot. Gard., Edin., Vol. X (1918), p. 201), Upper Burma.

Styrax Buchananii, W. W. Smith, *Styraceæ* (l. c. Vol. XII (1920), p. 234), Upper Burma, Bhamo District.

Syringa afghanica, C. K. Schneider, *Oleaceæ* (Wien. Ill. Gartenzeit, 1903, p. 106, in Obs. Ill. Handb, Laubholzk. ii (1911) p. 775), Afghan.

Thevetia neriifolia, Juss. *Apocynaceæ* (Gamble's Mad Fl. (1923), p. 821), Nat. in S. India, S. America.

Thunbergia adenophora, W. W. Smith, *Acanthaceæ*, Notes, Roy. Bot. Gard., Edin., Vol. X (1917) p. 747, Burma.

195. **Uraria pulchra**, Haines, *Leguminosæ* (Kew Bull., 1921, p. 308), Sameshwar Hills; borders of Nepal.

Vaccinium oreogenes, W. W. Smith, *Vacciniaceæ*, (Notes, Roy. Bot. Gard., Edin., Vol. XII (1920), p. 227), Upper Burma.

Viburnum Wardii, W. W. Smith, *Caprifoliaceæ* (l. c., Vol. X (1917), p. 77), E. Upper Burma.

LIST OF SPECIES NOT INCLUDED IN INDEX KEWENSIS.

1 **Acacia Balfouri**, Woodrow, *Leguminosæ* (Jour. Bomb. Nat. Hist. Soc., Vol. XI (1898), p. 429), Nat. in Western India, Socotra.

Aglaia littoralis, Talb., *Meliaceæ* (Talb. List Trees. Shrubs Bomb. Pres., (1902), p. 76), Konkan and N. Kanara.

Ardisia parviflora, Talb. *Myrsinaceæ* (l. c., p. 204), N. Kanara.

Chasalia virgata, Talb., *Rubiaceæ* (l. c. (1894), p. 114), N. Kanara.

5. **Dysoxylum glandulosum**, Talb. *Meliaceæ* (Jour. Bomb. Nat. Hist. Soc., Vol. XI (1898), p. 690), N. Kanara.

Eugenia kanarensis, Talb., *Myrtaceæ* (l. c., XI (1897), p. 236), N. Kanara.

E. memecylifolia, Talb., *Myrtaceæ* (l. c., p. 236), N. Kanara.

E. utilis, Talb., *Myrtaceæ* (l. c., p. 235), N. Kanara.

Lasianthus sessilis, Talb., *Rubiaceæ* (Talb. Sys. List Trees, Shrubs Bomb. Pres. (1894), p. 114), N. Kanara.

10. Loranthus gibbosus, Talb. *Loranthaceæ* (l. c., (1902), p 289), Konkan and N. Kanara.

Pyschotria canarensis, Talb., *Rubiaceæ* (l. c., (1894), p. 113) N. Kanara.

P. flavida, Talb. *Rubiaceæ* (l. c., p. 113), N. Kanara.

P. octosulcata, Talb., *Rubiaceæ* (Jour. Bomb. Nat. Hist. Soc., Vol. XI (1897), p. 237), N. Kanara.

14. Symplocos kanarana, Talb., *Styraceæ* (l c., p. 238), N. Kanara.

The following names are invalid under the International rules :—

1 *Arundinaria Phar*, E. G. Camus, *Bambuseæ* Les Bambusees (1913), p. 37), Lushai Hills.

Bambusa Kyathaungtu, E. G. Camus, *Bambuseæ* (l. c., p. 116), Burma.

Carissa gangetica, Stapf. in Herb. Kew, *Apocynaceæ* (Gamble's Mad. Fl. (1923), p. 805), S. India.

Diospyros sulcata, Bourd. *Ebenaceæ* (Bourd. For. Trees ; Trav. (1908), p 255), Travancore.

Eugenia Mundagam, Bourd. *Myrtaceæ* (l. c., p. 182), Travancore.

Gigantochloa Kachinensis, E. G. Camus, *Bambuseæ* (Les Bambusees (1913), p. 141), Burma.

G. Kathœnsis, E. G. Camus, *Bambuseæ* (l. c., p. 141), Burma.

G. Mogaungensis E. G. Camus, *Bambuseæ* (l. c., p. 141), Burma.

G. Tekserah, E. G. Camus, *Bambuseæ* (l. c., 141), Burma.

G. Toungooensis, E. G. Camus, *Bambuseæ* l. c., p. 140), Burma.

G. Wanet, E. G. Camus, *Bambuseæ* (l. c., p. 141), Burma,

G. Wunthœnsis, E. G. Camus, *Bambuseæ* (l. c., p. 141), Burma.

G. Yunzabinensis, E. G. Camus, *Bambuseæ* (l. c., p. 141), Burma.

Grewia Barberi, J. R. Drummond, *Tiliaceæ* (Gamble's Fl. Mad. (1915), p. 118), Madras.

G. Gamblei, J. R. Drummond, *Tiliaceæ* (l. c., p. 117), Madras.

G. Lawsoniana, J. R. Drummond, *Tiliaceæ* (l. c., p. 117), Madras.

G. pandaica, J. R. Drummond, *Tiliaceæ* (l. c., p. 119), Madras.

Hemicyclea travancorica, Bourd, *Euphorbiaceæ* Bour. For. Trees, Trav. (1908), p. 329), Travancore.

Phyllostachys Bawa, E. G. Camus, *Bambuseæ* (Les Bambusees (1913), p. 66), Burma.

P. Sedam, E. G. Camus, *Bambuseæ* (l. c., p. 66), Burma.

R. N. PARKER,
Forest Botanist
and
B. L. GUPTA,
Asstt. to Forest Botanist.

DEHRA DUN:
20th September 1924.

ENDLESS TRACK UNITS FOR FOREST TRANSPORT.

In many parts of the world conditions are such that the efficient operation of mechanical vehicles of any sort presents considerable difficulties. At the same time animal power is wasted in dragging wheeled vehicles over badly rutted routes or soft ground. To meet these conditions Messrs. Roadless Traction, Ltd., are now marketing a Roadless unit which is interchangeable with the wheels of bullock carts and wagons, timber drags, the heavier types of trailers, etc. These units are fitted in place of wheels on the existing axles of the vehicle; special bushes to suit the particular size and type of axle, being supplied with

the units. The conversion can be effected in a few hours by any moderately intelligent workman. Alternatively wagon builders can obtain the units complete with tubular axles if desired.

The advantage of these units is that over almost any given route the number of animals required to haul the load can be halved. As might be expected, these endless track units do not sink as the wheel does in soft ground or sand, nor is the route cut up and rutted, so that the rolling resistance of the vehicle progressively decreases. In addition, even on good roads, the rolling resistance is reduced to about half that of the wheeled wagon or trailer. Where good roads are available, therefore, Roadless units can still be employed with immense advantage.

Full particulars and prices of these units are available on application to Messrs. Roadless Traction Ltd., Gunnersbury House, Hounslow, Middlesex. In the near future arrangements will be made so that stocks will be carried in all the principal countries and cities of the world.

The price is £35 per unit nett., packed and delivered F. O. B., London Port. These units are equally applicable to single axle vehicles such as the Indian type bullock wagon.

REVIEWS.

THE AMERICAN LUMBER INDUSTRY.

REVIEW: THE AMERICAN LUMBER INDUSTRY, by NELSON COURTLANDT BROWN, B.A., M.F., New York—John Wiley and Sons, Inc.: London—Chapman and Hall, Ltd., 1923, I—XVIII; 1—279; figs. 1—36. Price 15*s.* net.

The subject of this book is such a vast one that its treatment would seem to demand an encyclopædia rather than a modest volume of some 280 pages, but Mr. Brown has succeeded in condensing into this space a very useful conspectus of the varied aspects of the industry.

In view of the preponderating importance of softwood, *i.e.* coniferous timber, in the wood-using industries of America and the world generally, this side of the lumber industry receives most attention from the author, which deprives the book of some of the interest which more details as to the hardwoods would have given it for readers in the tropics, but there is still plenty to be found in it for all readers.

For the general reader we would particularly recommend a study of the first two chapters, the price statement on page 134 and the chart on page 252 which shows the percentage of wood actually made use of from a tree. The comparison between the per capita consumption of the various countries should give food for thought to many. It also brings out the immense demands which modern civilisation makes on the forests of the world even in those countries where the lack of home grown timber has forced a certain measure of economy on the inhabitants. When one considers that England in spite of the development of wood substitutes uses some nine hundred million cubic feet of timber per annum, the ultimate demand of India as industries develop promises to be far in excess of the probable yield of her forests.

Perhaps the most striking point brought out by this book is the advantage of a general organisation of the timber industry which in the case of America appears to have not only made trading easier between different parts of the country, but to have brought about an actual economy in the manufacture of timber. It is too much to expect that the small timber dealer in India will take this to heart but there is no reason why the larger consumers such as the railways and the Public Works Department should not take up the question of standardising sizes and grades. Constructional engineers all over India might well read Chapter VI and consider whether there is not a real advantage to be obtained in standardising the defects admissible in timber for general use. In this respect India is in a better position than America. Highly specialised wood-using industries have not developed in various parts of the country to the extent that forty-nine grades of one

timber have become accepted and can only be given up at some expense in dislocation of the industry.

Marketing and Distribution are dealt with in considerable detail, but these sections though interesting in showing the intricacy of the timber business in America have not a great bearing on India's problems. One may imagine that most Indian traders would be aghast at the prospect of earning such a small percentage on their money as their opposite numbers in America have to content themselves with. The 8½—9 per cent. earned by the southern pine companies would hardly attract the chetty sawmill owner or the local money-lender as an investment.

Therein lies the problem of India's timber trade. Can it be built up on a basis of 12—24 per cent. loan money?

SOIL ACIDITY AND ITS RELATION TO AMMONIFICATION AND NITRIFICATION IN WOODLAND SOILS.

SOIL ACIDITY AND ITS RELATION TO THE PRODUCTION OF NITRATE AND AMMONIA IN WOODLAND SOILS, by G. R. CLARKE, B.A., B.SC., Research Scholar of Oriel College, Oxford Forestry Memoir, No. 2. (Clarendon Press, 1924, pp. 27, Figs. 12, price 3*s.* 6*d.*)

The close relation between the plant and its habitat is well known. The climate and the characteristics of the soil of a particular region determine the natural vegetation, the survivors being those which are best adapted to the entire environment, and the very form and development of the trees being correlated to the edaphic conditions. For example, it has long been known that the reaction of the soil is an important factor in the distribution of agricultural plants and forest trees. For each kind of plant there is specific reaction range over which its growth is most successful.

It may not be out of place here to point out that there is a distinction between two aspects of soil acidity. The total acidity of a soil is a quantity factor and is measured by the amount of base which must be added to the soil to combine with the whole amount of acid present. The active acidity of the soil,

the concentration of the hydrogen-ions, is, on the other hand, a measure of the intensity factor of soil acidity. There need be no direct relationship between these two as any comparison would be a comparison between the measurement of two distinct factors. This point may perhaps be made clear thus. A particular dilution of lime juice may be found to be so strong as to set the teeth on edge. But the addition of salt to it improves matters and makes it taste less sour than it is before the addition. The total amount of acid present in the solution is the same as before, but the intensity of sourness becomes modified in the presence of salt.

Considerable attention is being given in recent years to the relation of soil acidity to plant growth. It is of practical utility to find out the optimum reaction ranges for the cultivated plants, so that suitable soils may be selected for particular crops or that even the soil reaction may be adjusted by the application of the proper soil amendments. Some amount of work is also being done in the case of the forest flora. It is of interest to quote here the result of Olsen's researches in Denmark on the significance of soil acidity to the vegetation, especially the natural distribution of plants. The hydrogen-ion concentration appeared to have an essential influence on the composition of the plant formations, as single species only were found in soils the hydrogeni-on concentration of which lay within a certain range characteristic of each single species. Within this range there was found a narrower range in which the species had its greatest average frequency.

In the correlation between soil types, and forest types and plant associations, the activity of the micro-flora of the soil is a very significant factor. Of the numerous bacteria in the soil which take part in the elaboration of plant food materials, those which bring about ammonification and nitrification are of great importance. Though plants obtain slight amounts of nitrogen from other sources, they obtain by far the greater portion from the soil in the form of nitrate. A study of the activities of these bacteria as related to hydrogen-ion concentration is thus of great value and Mr. G. R. Clarke's memoir is very opportune.

The author begins with a résumé of the more important literature on the subject, and after briefly discussing the cause of soil acidity describes the methods of analysis adopted by him. The concentration of hydrion was determined by Gillespie's method, and the lime requirement measured by Hutchinson and McLennan's method. The estimation of Ammonia was made by Mathew's method. The "loss on ignition" figure was taken to present the organic content of the soil. This loss in weight, as is known, is due to the escape of water and carbon dioxide as also to the combustion of humus and the unhumified plant residues, the influence of which last on soil conditions is not at all so profound as that of humus. The loss in weight is thus not due solely to the disappearance of organic matter. But it is necessary in ecological technique to restrict the procedure to relatively simple processes. Moreover, the present state of our knowledge of the organic substances existing in the soil is still very incomplete. It is therefore difficult to devise a satisfactory substitute for the empirical method of estimating organic matter by the loss on ignition. In special instances where this method is obviously inapplicable, *e.g.* in the case of highly calcareous Pusa soils, the writer of this review found that significant figures about the humus content are obtainable by the relatively simple process of colorimetric comparisons of soil extracts.

The determination of nitrates was done by the phenol-disulphonic acid method. This method is very convenient and does not give any trouble in the case of normal soils. But when applied to soils having a large amount of decomposing organic matter the extract is highly coloured. The yellow colour noticed in the case of the acid soils has been thought by Mr. Clarke to be due to the lack of lime in the soil. This does not appear to be correct as he found that some of the solutions were not clear even when the soils were extracted in the presence of finely divided calcium carbonate. Moreover the reviewer experienced the same trouble in the case of some heavily dunged Pusa soils which are very rich in calcium carbonate. The difficulty was overcome at Pusa by the addition of lime to the

extract whereby the colloids are flocculated and the colouring matter removed from the solution. It is interesting to find that the same procedure was adopted by Mr. Clarke in his present researches.

The soils studied by Mr. Clarke were taken from Bagley Wood near Oxford. The results showed that—

(*a*) There is a definite relationship between the Lime Requirement of a soil and its organic content.

(*b*) The pH value of a soil growing a forest crop is least acid when the crop is in full growth.

(*c*) The accumulation of ammonia is greater in very acid soils than it is in slightly acid and neutral soils.

(*d*) The ammonia of a very acid soil is liable to rapid fluctuation.

(*e*) The soil shows a great retentive power for ammonia when in certain conditions of moisture content.

(*f*) Nitrate is present in measureable quantities in very acid soils, and is apparently independent of seasonal changes under the conditions of these investigations.

The author is to be congratulated on his useful publication.

J. S.

INDIAN BIRDS.

REVIEW : BIRDS OF AN INDIAN GARDEN, by T. BAINBRIGGE FLETCHER and C. M. INGLIS. IN five parts. Price Rs. 2 per part ; 1924. Thacker Spink & Co.

Though much has been written on Indian Birds, no popular book has yet appeared dealing at least with the commoner birds with coloured illustrations of every species dealt with. There is an undoubted demand for such a work.

A large number of the European residents and visitors in this country, as well as many Indians take a real interest in birds, but they are discouraged by the fact that the standard works on Indian ornithology, *viz.*, Jerdon's Birds of India and the four volumes of the Fauna of British India treating of birds are not

provided with illustrations. Moreover the former work is completely out of date and both it and the Fauna of British India are expensive and difficult to obtain.

Douglas Dewar has written several books on Indian birds which are excellent in their way but they lack one great essential to popularity, *viz.*, coloured illustrations.

The present work is a beginning in the right direction, but it only deals with 30 birds (Part I describes and figures 6 birds only). Whereas what is really required is a comprehensive work treating of at least all the birds most frequently met with in the plains and hills of India.

Part I of the work now under reference is a very good commencement. The letter-press is excellent and the coloured illustrations generally good, though a little hard. The Jungle Crow in Plate I is a little too stout, and its nest and eggs are not very good. The Indian House Crow (Plate II) is much better. The Bengal Tree Pie (Plate III) is also good but the beak of the bird is hardly stout enough. The Seven Sisters (Plate IV) are well drawn but the colouring is not correct. The birds should be *ashy brown* and not rufous brown as is depicted. The Red-vented Bulbul (Plate V) is excellent, as is also the King Crow (Plate VI), though in the last plate the King Crow chasing the Lagger Falcon in the near distance should have been drawn smaller in comparison with the falcon, a bird several times its size.

The book will undoubtedly help to fill a longfelt want, and we hope it may be possible to extend it to a much larger number of species in the future.

EXTRACTS.

EUCALYPTIAN FACTS.

Eucalypts will not regenerate or develop in shade; they demand the full sunshine and are classed as intolerant, or strong light demanders; they spring up in exposed places more or less directly from the mineral sub-soil; as seedlings they assert them-

selves immediately and gain dominance by extraordinary rapid height growth; as poles they extend in open order through the forest, and as veterans they stand in the light of everything else.

Because of their wide spacing there is ample room beneath them for other species; the shade they cast is not heavy, scarcely heavy enough indeed to oust grass, itself a fierce light demander; their litter of leaf and bark, however, tends to extinguish grass growth but produces its own antidote of bush fires which aids grass to ascendency by disposing of the encumbering débris and by thinning the Eucalyptian canopy.....

The essentials of *Eucalyptus* regeneration are—

(*a*) A clear opening of sufficient extent;

(*b*) A regeneration fire to (1) destroy caterpillars and grasshoppers which would eat the cotyledonary seedlings, (2) provide an ash-barrage against ant attack, (3) furnish a suitable level seed bed of fine tilth, (4) repress root competition from ground shrubbery, (5) eliminate soil acidity;

(*c*) Ample supplies of seed from adjoining standing trees, from ringbarked trees on the opening, or from the ground if it were true that the seed remained stored there and survived the regeneration fire or were unburdened by it of overlying litter and vegetation;

(*d*) Sufficient rainfall at the right time;

(*e*) Protection against (1) suppression by coppice shoots, or other vegetation; (2) falling limbs from the dead canopy overhead; (3) *succeeding fires*.

The question of fire protection, therefore, is bound up intimately with the problem of Eucalypt regeneration. Fire must be used for regeneration purposes and not afterwards. Yet fire is a natural consequence of the *Eucalyptus* forest conditions of dry sites and dry underwoods and dry undergrowth, open stands and grass.

The matter of fire protection further is a matter of grazing control and we are reduced to the proposition of a *Eucalyptus-cum*-grass mixture, with grazing control.

Graziers insist on periodical firing for grass production; periodical fires damage Eucalypt regrowth and undo all the good that they do in the regeneration phase.

The Western Australia Department of Forestry is applying itself fruitfully to the problem and has secured very interesting results. Briefly, the system it has evolved thus far is as follows :—

(*a*) The forest is divided into logging blocks;

(*b*) The miller is awarded a logging block more or less equal to the periodic capacity of his mill, and to be cut out as thoroughly as possible before being granted a new block;

(*c*) A light fire is run through each cutting area by the Forest Department prior to felling operations by the miller. This can only be done when the weather warrants and will apply only to the area to be cut over during the current year;

(*d*) The Forest Department workmen follow the fallers and clear the débris for a distance of about three feet from around the trees and poles it is desired to protect. Limbs which stick up from the fallen trees and are likely to carry fire into the tops of adjacent trees are lopped;

(*e*) The crowns of fallen trees are burnt as soon as possible after the débris has been removed from around the trees requiring protection. The burning of the inflammable leaves and branchlets suffices.

Queensland procedure is similar. It is preferable for the Forest Service to arrange its own felling (on contract) subject to the conditions :—

(1) Forest Service controlled creeping fires to precede felling wherever such can be managed;

(2) Fallers to cut in a face within the confined limits of a block or compartment and to clear all débris 3 ft. (at least) away from useful immature growth (only) left behind; sleepergetters and girdergetters similarly;

(3) Forest Service to inspect and complete removal of all merchantable growth ; ringbark useless trees and burn off the inflammable débris of the workings immediately after the felling.

Thereafter fire protection is vital. The fire plan will take four forms—

(1) Fire season lookout and patrol with instant detection, location and suppression as the objectives.

(2) Fire beating from the tail pinching in the sides to the head ;

(3) Fire protection propaganda and co-operation as between settler and forest officer ;

(4) Fire belt burning off around regeneration areas, plus road fire brake planning.

Eucalypt regeneration develops rapidly after establishment, the stand of seedlings is extremely dense, but thins out rapidly because of its intolerance to shade this natural thinning should be aided by artificial thinnings in the pole stage and a very open stand of full-crowned poles developed when the underwood and undergrowth may be reduced to grass to be heavily stocked and periodically burned over by slow-creeping Forest Service controlled fires (preceded by removal of débris from around the base of desirable trees).—[*E. H. F. Swain, Director of Forests* in *Queensland Agricultural Journal, January 1924.*]

CHIENGMAI LACQUER WARE.

The basis of the lacquer used in Chiengmai*, as of that of Burma, is the resin of the *rak* tree (*Melanorrhœa usitata*). In China and Japan lacquer is made from the resin of other, though nearly related trees.

The *rak* tree is fairly common throughout the greater part of Siam ; it is found in that type of dry deciduous forest known in the South as *pa dêng*, in the North as *pa pê*, and ranges in altitude from near sea level to about 4,000 feet.

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* Chiengmai is the chief town of Northern Siam and is the centre of the northern teak trade.

Rak resin is chiefly used for making lacquer ware but it is also employed for waterproofing bamboo-woven vessels intended to hold water. The resin sometimes produces inflammatory skin eruptions on those who handle it ; individuals vary greatly in their susceptibility to this irritating action, some can handle it with impunity while others are so affected that they dare not touch it. It may be mentioned here that a mixture of *rak* resin and teak sawdust has some reputation among the Laos as a remedy for leprosy. Teak sawdust is also used to allay the irritation caused by handling the resin.

The resin can be collected throughout the year but the best times for doing so are at the end of the rains and in the hot season. If collected during the rains the resin gets mixed with débris washed down from the trunk of the tree, while in the flowering season, about December and January, the yield of resin is very poor.

The resin is obtained by making V-shaped incisions in the bark of the tree, a bamboo joint to receive the resin which flows from the incisions being stuck into the bark at the bottom of the V. On a good tree 20—30 of these incisions may be made at one time. The resin continues to flow for seven or eight days when the bamboo joints are taken down and the resin they contain emptied into a larger vessel. A thin layer of water is poured over the surface of the resin to keep it from drying up. When fresh the resin is of a reddish black colour, when dry it is a pure glistening black.

Three qualities of resin, depending on the season of collection are recognised, they are—

(1) *Rak ki kwai*, a poor quality resin, collected in the rains.

(2) *Rak dêng*, a resin of good quality, collected at the end of rains.

(3) *Rak nam nai*, considered the best resin, collected during the hot season.

Adulterants are sometimes used ; the commonest are water and the oil of the *vang* tree (*Dipterocarpus alatus* and *D. turbinatus*). One method of testing the resin is to thrust a stick into it, if there are no impurities the stick comes out evenly

coated with a smooth glistening layer of resin, if, on the other hand, the stick comes out only coated in patches, or without the smooth glistening appearance, it is adjudged that adulterants have been used.

A great part of the resin used in Chiengmai is brought down from the neighbourhood of Muang Hang in the Shan States, some also comes from the regions of Doi Saket and Me Wang in the province of Chiengmai. Good resin fetches about 18 ticals for a kerosene tin full ; the price, however, varies somewhat from season to season and from year to year.

A small amount of lacquer ware, chiefly for personal use and usually rather roughly finished, is made in various parts of Northern Siam by Laos, Shans and Karens, Chiengmai is, however, the only place where there is a large output of lacquer for trade purposes.

The manufacture of this lacquer ware probably goes back hundreds of years. One family in Chiengmai has been engaged in the business for at least five generations ; the oldest living member of this family is 86 and still well though now past active work. Most of the Chiengmai lacquer workers, like other special craftsmen, are congregated in one neighbourhood, the Pratu Chiengmai. The articles commonly manufactured are round betel-boxes, bowls, trays, cigarette cases and water bottles. Large pieces of furniture, such as chair, tables and cabinets are also turned out, but only when specially ordered.

The characteristic Chiengmai ware is black and red but a good deal of black and gilt is also made. Of recent years other colours have been used but these are obtained by applying oil colours over the lacquer. An ordinary piece of black and red lacquer, that is red lines on a black background, has to go through a number of processes and requires three weeks or more for its completion. Very fine lacquer work has to be treated with much greater care and takes longer to finish, one piece may occupy some six or seven weeks in the making. This very fine work is not seen in the market and is only made to special order.

Woven bamboo is the foundation of most of the lacquer ware but solid wood is also used. The commonest form of these wooden

articles is a round tray. These trays are made from the wood of various trees, chiefly *mai tun ten* (*Duabanga sonneratioides*) and *mai wit* (*Garuga pinnata*). The woodwork of these trays is completed in villages outside Chiengmai. They are first roughly shaped with a knife and then finished off on a simple lathe ; one man can turn some 10 to 15 trays in a day. The trays when turned are taken to Chiengmai and there sold to the lacquer workers at the rate of about 18 ticals for a hundred trays. These trays when lacquered are usually finished off in plain red.

As already mentioned the bulk of the lacquer ware is on a foundation of woven bamboo. The bamboos used for this purpose are *mia hia* (*Cephalostachyum pergracile*) and *mia bong* (*Bambusa tulda*). The ribs of the plait are made of very thin bamboo strips $\frac{1}{4}$ to $\frac{1}{2}$ inch wide while the actual plait is done with fine bamboo strands, 1/16 inch or less in diameter. The plaiting is usually done on a wooden mould cut to the shape of the utensil required ; with large articles a mould is dispensed with. Women and young girls, who are very skilful and neat at the work, do a great deal of this bamboo plaiting ; indeed considerable skill is essential in the case of round boxes where it is necessary to be very accurate otherwise the lids would not fit closely. When the plaiting is finished a rim, about $\frac{1}{2}$ inch wide, of *rak* resin is painted round the edge of the plait, this keeps it from unravelling in the subsequent processes. After the rim of *rak* is dry the article is smeared, inside and outside, with a thick emulsion formed by the mixture of *rak* with water, the exess of the emulsion being taken off with a broad, short-bristled brush. The article is then laid aside to dry for two or three days. The main object of this treatment is to keep the plaiting firmly in place during the next process, the emulsion being less likely to crack and splinter under the knife than pure *rak* would be. When dry the article is shaved smooth with a sharp knife, any irregularities in the plating being removed by this process ; if the article is round the shaving is done on a lathe. A mixture of *rak*, ash of paddi husk and very fine earth, well mixed and made into a thick paste, is now spread over the article with broad brush. This paste fills up all interstices in the plaiting.

The earth used must be very fine and quite free from grit or sand otherwise it is impossible to get a good surface on the finished article. After this application another drying is necessary and then the surface is smoothed down, on a lathe if possible, with a fine grained stone, the surface rubbed being kept constantly wet. The article now receives three coats of pure *rak*, being allowed to dry, in a cool shady place, between each coat. This process takes from 5 to 15 days according to the weather. In very hot weather, drying is difficult, it is usual than to dry the articles in underground pits ; this is not necessary in the rains or cold season when drying can be done in a shed. As soon as the third coat of *rak* is dry the surface is smoothed down, this time with the rough leaves of a fig tree (*Ficus cunia*) known as *bai nawt* (Lao) or *bai lin sûa* (Siamese).

Before this last polishing the article, if a round one, is tested on a small lathe to see if it is truly round ; if not it has to have further applications of the ash paste and revarnishings till it is so.

This seldom has to be done as, considering the rough methods used, the round boxes are wonderfully accurate both in their roundness and in the fitting of their lids.

The article is now ready for the engraver who cuts the pattern with a fine steel style, going through the outer coats of *rak* to the ash mixture beneath. The pattern followed is usually a conventional one of small flowers and leaves closely set over the whole surface. Occasionally other subjects are chosen, such as the animals representing the cycle of years, but even so the spaces between the animals are filled in the conventional design. Whatever may be the pattern chosen it is done without a copy of any kind. An ordinary betel-box can be engraved in less than a day but two to three days would be taken on the same sized box for finer work in which the flowers and leaves are smaller and more closely set. After this engraving there is left a pattern of grey lines on a black back-ground. Sometimes the article is left in this state but more usually it goes through further processes to produce red or gilt lines.

When the pattern is to be red, as is most frequently the case, the whole surface, after engraving, is painted over with

a mixture of red lead, *rak* and *mak mû* oil, an oil expressed from the seeds of the *mak mû* tree (*Parinarium albidum*). This is allowed to dry and then the surface is rubbed down with *nawt* leaves which take off all the red except that in the engraved lines. The final treatment is a coat of a varnish made by mixing pork fat and *rak*. When a pattern of gilt lines is desired a slightly different procedure is followed in the latter stages. After engraving a coat of *rak* is painted over the article and while this coat is still wet gold leaf is laid on and spread smoothly over the surface being pressed well down so as to enter the engraved lines, the article is then rubbed with a cloth which removes all the gold leaf except that in the lines.

A bolder design in gilt and black, often representing conventional lotus buds, is obtained by still another method. The article goes on to the third coat of *rak* as already described, but, instead then of engraving a pattern, the design is marked out with a yellow pigment in watery solution. The pigment is painted over those portions which are to be black in the finished product. When the pigment is dry gold leaf is spread evenly over the whole surface and a coat of *rak* given. After allowing this coat to dry the article is washed and gently rubbed till all the gold leaf over the pigment, together with the pigment itself, comes away, that over the unpigmented portion remaining.

The methods sketched above are those followed in obtaining the three chief types of Chiengmai lacquer, red lines on black, gilt lines on black and black and gilt in broad design.

It is not easy to arrive at any estimate of the number of people engaged in this business or to compute the amount of work turned out annually. While the actual lacquering is usually done in regular establishments, some of the work, such as plaiting and engraving, is taken away to the workman's, or workwoman's own house. The number of workers varies from day to day, each person working as he has the time or inclination to do so. During the seasons of planting and harvesting rice very little lacquer work is done. Considerations such as these make it difficult to say how many workers are engaged in the trade, they probably do not exceed five hundred.

The estimate of the number of lacquer articles made and their value is no easier as manufacturers keep no records of their sales. One of the largest manufacturers estimated that he turned out about 10,000 articles a year and that this was about a tenth of the total output of Chiengmai, which would give an annual output of 100,000 articles for the whole of Chiengmai.

Articles vary greatly in price according to their size and workmanship, small pieces can be bought for 20 or 30 satangs each while large pieces, or those of specially good workmanship, may run to as many ticals. It is probable that the average price of all articles, taking the large with the small, is approximately one tical, which, with the above estimate of annual output, would make the value of the lacquer ware annually made in Chiengmai somewhere about 100,000 ticals.

The above figures must be considered a very rough estimate indeed, they are only put forward as giving some indication of the importance of the lacquer trade in Chiengmai. At present the lacquer ware is used almost entirely within the country but the trade could readily expand if an outside demand arose as there is a plentiful supply of the raw materials.—[*The Record*, 1923.]

CORRESPONDENCE.

[NOTICE.—Correspondents who wish their letters to appear in a particular number of the *Indian Forester* should ensure that they reach the Honorary Editor by the 15th of the previous month. Unless exceptionally long they will be inserted.]

A FORESTRY ASSOCIATION FOR INDIA.

SIR,—In the Septemher issue of the *Indian Forester* your correspondent "Young Hopeful" deplores the fact that the Empire Forestry Association has been established on a sound foundation everywhere except in India.

He goes on to advocate the creation of an Indian Forestry Association; and, at the outset he says "an unofficial organisa-

tion is the best means of overcoming administrative difficulties particularly in this country wherein, all political creeds are allied against the Government."

He then writes, "The question then arises how to proceed Clearly the send-off must be official; and it is justifiable, in view, of the public interest at state, to spend money from public funds until such time as the Association can support itself and become independent"

Everyone who knows India will agree with "Young Hopeful" that an Indian Forestry Association would be useless if it were official, and could never be started if it were unofficial. If "Young Hopeful" wishes to join an Association why does he not join the Empire Forestry Association instead of advocating such a futile alternative?

R. G. M.

DOMESTIC OCCURRENCES.

BIRTH.

CHAMPION.—At Lansdowne, United Provinces, on the 4th September 1924, to the wife of F. W. Champion, I.F.S., a daughter.

Fig. 1. Vertical view. The dark grey forest is *kanazo* (*Heritiera minor*), light grey is mainly *myinga* (*Cynometra ramiflora*). On the inner curve of the main stream is a *byuchidauk* mud-bank (*Rhizophora* sp).

Fig. 2. Oblique view. *Kanbala* (*Sonneratia apetala*) over young *kanazo* (*Heritiera minor*) in foreground. In the background dark forest is mature *kanazo*, grey is mainly *myinga* (*Cynometra ramiflora*).

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THE AERO-PHOTO-SURVEY AND MAPPING OF THE FORESTS OF THE IRRAWADDY DELTA.

[NOTE.—The following is an advanee copy of the general report on the aero-photo-survey. Full reports by the various officers employed will shortly be issued in a special bulletin.]

PART I.—DESCRIPTION OF THE AREA.

Area included in the survey.—The forests over which the aero-photo-survey has been carried out are the reserved forests on the Delta Division, Burma. They are situated in the Myangmya and Pyapon Civil Districts and extend to just over 1,000 sq. miles. A rough estimate of their area is given below :—

Kyaukkon	2	sq. miles.
Lebyauk	41	„ „
Kyagan-Kwinbauk	97	„ „
Pyinalan	145	„ „
Kakayan	100	„ „
Labutkwe	21	„ „
Kalayaik	31	„ „
Nyinaung	25	„ „
Kadonkani	213	„ „
Meinmahla	49	„ „
Pyindaye	306	„ „
Total ...	1,030	„ „

About 350 sq. miles of waterways and unclassed forests were also included in the survey.

Configuration.—The area forms part of the Irrawaddy Delta. 'Other than a low ridge in the Myaungmya District on which the Kyaukkon and Lebyauk reserves are situated and which rises to a height of not more than 120' above the average sea level, the whole area is essentially deltaic being formed by the alluvial deposits of the Irrawaddy. The plain so formed is intersected by large and small rivers and creeks and by cross channels dividing it up into numerous islands. As the level varies by only a few inches, except in the case of a few sandy ridges near the sea face which are 3 to 5 feet above the average and small areas further north, the whole country is submerged at spring tides during the rains and much of it also during neap tides at other seasons of the year. This variation in level combined with the degree of salinity of the water, which floods the forest, is the main factor in determining the kind of tree growth."*

Description of the Forests.—A full description of these forests is given in the working plan for the Delta Forest Division by Mr. A. W. Moodie, O.B.E. Briefly the forest may be classified into the following main types:—

1. Pure or almost pure forest of *kanazo (Heritiera minor)*. This covers large areas and is the most valuable class of forest in the Delta.

2. Mangrove forest containing various species of the natural order *Rhizophoraceæ*. These forests are usually confined to the mud banks along creeks.

3. Low scrub jungle commonly known as *byaik* which may be of three types—

(*i*) Characterised by the presence of *thinbaung (Pœnix paludosa)*.

(*ii*) Characterised by the presence of *myinga (Cynometra ramiflora)*.

(*iii*) Characterised by the absence of real tree growth and by the presence of tall grasses and creepers.

*Extract from Working Plan for Delta Forest Division, by A. W. Moodie, Esq., B.E., 1924.

4. *Kanbala (Sonneratia apetala* and *lamu (Sonneratia acida)* are characteristic of newly formed mud banks, the former mainly in salt water, where single trees survive to tower above the other growth when the level is gradually raised, and the latter mainly where the water is fresh.

5. Low forest characterised by an abundance of *madama (Ceriops Roxburghiana).* Similar to this is a low mixed forest characterised by *madama* and *thayaw (Excœcaria Agallocha).*

6. Higher level forest where the growth approaches more nearly to the ordinary low level evergreen type and contains such species as *kanyin (Dipterocarpus alatus)* and *sinnin thayet (Mangifera caloneura).*

7. Grassy blanks.

Previous surveys.—Until quite recently the only map available was Fitzroy's reconnaissance map on a scale of 4 miles to the inch dating from 1864, which although very good of its type was not sufficiently accurate for the work required. Starting from 1918-19 the Pyindaye Reserve was surveyed on a scale of 4 inches to a mile by a special party under the orders of the Commissioner of Settlements and Land Records. The costs of this survey was paid by the Forest Department in 1922-23 and amounted to Rs. 26,626 or Rs. 87 per sq. mile for the 306 sq. miles of this reserve. The survey has since been proved to be very inaccurate. Only the main rivers were accurately surveyed and the artificial boundaries of the reserve, even where properly demarcated, have not been correctly shown.

In 1921 Mr. A. W. Moodie, O.B.E., was posted to the Delta Division and promptly commenced a survey of the reserves by cutting linear survey lines at intervals of one mile usually from east to west and from north to south. The lines were made with the aid of prismatic compasses and were measured with a chain, all natural features such as streams and all changes of forest type being noted. This work was commenced before the aerial survey had been proposed and the results have allowed of the first working plan ever made for these forests to be drawn up. This survey only cost Rs. 15 per sq. mile and though it

cannot compare in accuracy with the aerial survey it was a notable effort and gave valuable information about the reserves.

Difficulties of ground surveys.—To anyone who has visited deltaic forest the difficulties of an accurate ground survey are obvious. Wide waterways with a rapid current ebbing and flowing with the tide; mud banks in which at every step the surveyor sinks to the knees or even further; at high tide large tracts under water too deep to walk in; small creeks only navigable at high tide in small boats and then on the so-called land even at low tide a mass of aerial roots, which make walking slow and painful and a dense tangled undergrowth through which every step has to be cut; all this tends to make ground survey on an accurate scale slow and extremely expensive. It is estimated that survey on a scale of 4 inches to 1 mile would have cost fully Rs. 500 per sq. mile and would have taken 3 or 4 years.

Suitability of the country for aerial survey.—On the other hand the country must be considered specially suited for aerial survey. In the first place it is level and therefore there was no difficulty with heights or contours. In the second place the profusion of large rivers allowed for safe landing places within easy distance of any part of the area. In the third place all small creeks that were not entirely overhung by trees would be visible from the air and these form practically the only natural features required to map. Finally the forest contained several most distinctive types, chief of which, the *kanazo* forest was almost pure and, from ground level at least, of a most distinctive appearance and it was believed that useful data of the distribution of the different types of forest would be given by aero-photography.

II.—Preliminary negotiations.

Origin of the idea of aerial survey.—The idea of an aerial survey appears to have originated with Mr. E. F. A. Hay, I.F.S., who was posted on special duty to these reserves with the object of preparing stock-maps and colonising those parts of the reserves where the stock was poor and the area more suitable

for paddy cultivation than forest. The idea appears to have, received but little consideration until these reserves were inspected by Mr. H. W. A. Watson in April 1920 when he was Conservator of the Delta Circle. Mr. Watson made the following note in his inspection report :—

" The question of aerial survey suggested by Mr. E. A. Hay in his report was not seriously considered. *Nevertheless I would venture to urge that this question of aerial survey be seriously considered*. Owing to the dense forest growth, the diversity and number of the creeks and the absence of fresh water a survey on the ordinary lines, which would have to be supplemented by a stock-map also on the ordinary lines, will be a cumbrous and expensive process.

Whereas conditions for aerial work are ideal ; not only so but an aerial survey would at once show up the *kanazo* stocking which is abrupt and easily distinguishable in appearance and colouration from the other growth and thereby save the further cumbrous elaboration by the usual means of a stock-map.

The saving in time should also be a consideration. The ordinary method will take years, the aerial method weeks."

The chief credit not only for the original idea of the aerial survey but also for the enquiry and negotiation leading up to the operation must be given to Mr. Watson. In spite of discouragement and difficulties he has persisted with the project, the success of which fully justifies his most sanguine expectation.

Mr. Watson went to Engand on leave later in 1922 and while there made several enquiries into the possibility of aerial survey and useful information was obtained from the Air Ministry, the War Office and several private individuals. In this connection mention must be made of much assistance and advice given on several occasions by Mr. Ellwood Wilson, formerly of the Laurentide Timber Co. of Quebec and now Managing Director of the Fairchild Aerial Surveys Company, Limited, of Grand Mere, Quebec. The success of aerial photography in the work of stock-mapping and surveying of their forests by the Laurentide Timber Co. formed the basis on which the success of similar operations in the Irrawaddy Delta could be determined.

Progress of negotiations.—On Mr. Watson's return to Burma late in 1920 the matter was taken up vigorously and early in 1921 it was discussed with Col. Ryder and Col. Coldstream, Surveyor-General and Superintendent, Eastern Circle, Survey of India, respectively. At that time the most recent experience of aerial survey in India had been incorporated in a paper by Major Lewis and Captain Salmond on experiments in airplane photo surveying. From these experiments it appeared that there was very considerable difficulty in flying straight enough to obtain a regular series of strips covering a given piece of country and Col. Ryder considered that it would be better to go slow and obtain further experience before air survey in the Delta could be taken up.

Correspondence during 1921 with one or two firms which had been formed for air transport and air survey led to nothing.

In January 1922, Mr. Kemp, then Chief Inspector of Aircraft, India, came over to Burma to investigate aviation possibilities. Mr. Watson took this opportunity of discussing the aerial survey of the Delta forests with him during his visit and, as a result, in the following August, a conference on the subject met to discuss the matter in Maymyo. At this conference the Chief Conservator of Forests, Mr. Smales, the Surveyor-General for India, Col. Ryder, the Superintendent, Eastern Circle, Survey of India, Col. Coldstream, Mr. Kemp and Mr. Watson were present. It was generally agreed that the project was perfectly feasible and Mr. Kemp was asked to prepare detailed estimates for the work for 1,000 sq. miles. These estimates were sent in November 1922, a copy being sent both to the Local Government and to the Surveyor-General. The Surveyor-General promptly promised the co-operation of his department and undertook—

(1) The fixing of the necessary points and

(2) The fair drawing of sheets for publication.

He also stated that he did not propose to make any charge to the Burma Government for these services as they would be useful for the ordinary 1-inch topographical survey which was an Imperial charge. He strongly recommended the acceptance of Mr. Kemp's estimate. From this time on the arrangements for the

air survey were in the hands of Col. Gunter, Superintendent, Burma Circle, Survey of India, who had had considerable previous experience of aero-survery. After some further negotiations, the estimate was recast more especially in view of the fact that the Survey of India had undertaken all the work in connection with the fixing of points and the preparation of the final map. It then remained to obtain the approval of the Local Government to the work and the provision of funds for the year 1923-24. The most important matter was to persuade the Finance Committee that the operation was desirable and advisable and this was not done without some difficulty. A meeting in May 1923 decided to postpone a further consideration until a later meeting. At this later meeting the case in favour of the survey was most ably put by Col. Gunter, Superintendent, Burma Circle, Survey of India, and it was mainly owing to his efforts that the Finance Committee passed the project readily. In the meantime Mr. Kemp had left the service of Government owing to the termination of his appointment and he was therefore a private individual with a free hand to carry out the work. A contract was drawn up between the Government of Burma and Mr. Kemp of which the main details are given in the following section :—

Details of the contract drawn up with Mr. Kemp.—Briefly the conditions of the contract were that for a payment of Rs. 2,75,000 for the first 1,000 square miles and for Rs. 28,000 for a further 350 sq. miles to be added later, if considered necessary the contractor (Mr. Kemp) undertook to carry out the following work :—

The production of vertical and oblique photographs suitable and necessary for the compilation of a 4 inch = 1 mile scale map of the area—(*N.B.*—The scale was later altered to 3 inch = 1 mile as this was found more convenient for mapping from the photographs.)

The following conditions were imposed :—

1. The Survey of India were to be responsible for the fixing of the trigonometrical points necessary to control the mosaic, the compilation of the mosaics and resultant maps.

2. Vertical and oblique photos were to be submitted to the Survey of India to enable them to compile a forest map and to the Forest Department to enable them to compile a stock-map.

3. All land areas to be covered by vertical photos including water channels of such width that both banks could be included in one photo.

4. Negatives to be 7″ × 7″ or 5″ × 4″. (The latter alternative was taken.)

5. Overlaps both forward and lateral to be 30 per cent. and in any case not less than 20 per cent.

6. Departure fro n mean height at which photos to be taken not to exceed 1 per cent.

7. Photos to be free from tilt. Tilt in no case to exceed 3°.

8. The quality of the photographs to be such that no difficulty should be experienced in picking out all details necessary for the map.

9. Photography to be carried out at about the same time each day to be decided after experiment. Narrow channels not to be entirely obscured by cast shadows of the trees alongside.

10. Vertical photos on a scale, larger or smaller than the normal, to be taken to elucidate difficulties met with in the compilation of the rectified mosaic.

11. Negatives to become the property of the Government of Burma.

12. Two prints of every vertical photo taken as well as one print of all oblique photos and two extra prints of such photos as may be required to be supplied to the Survey of India.

Two prints of all photos required by the Forest Department and a rough mosaic to be supplied to the Forest Department.

III.—Carrying out of the survey.

Note.—Full reports on the work carried out and results from each point of view have been drawn up by Mr. Kemp and the special officers employed on the work and will shortly be issued in a bulletin. Only a rough summary will be given here.

Ground control.—This was carried out during November, December 1923 and January 1924 by No. 18 Party (Aero-photo) of the Survey of India under the able control of Major C. G.

Lewis, R.E., and consisted in the triangulation of fixed points. which would be recognisable on the photographs.

Aerial photography.—A base for the aeroplanes was formed in Rangoon at Monkey Point some 90 miles by air line from the centre of the area to be surveyed. A movable emergency and advance base was formed by a launch with a motor boat and *sampans* attached. The type of seaplane used was a D. H. 9 Puma engined service type aeroplane converted to a seaplane by the fitting of floats especially designed by Mr. Kemp. Full details of the seaplanes and of the photographic apparatus used is given in Mr. Kemp's report. Flying Officer, Mr. J. Durward was lent on leave without pay by the kind permission of the A. O. C., Royal Air Force (India), for employment as photographer and Major C. K. Cochran-Patrick, D.S.O., M.C., late of the R. A. F., was retained as pilot.

Photography was commenced in February 1924 and completed early in April 1924. The start was delayed owing to delays in the settlement of the contract. January and February would have been the best months to have carried out the work as weather and visibility are both better at that time.

Examination of the forests with a view to determining how the different types of forest could be determined from the photographs.—Mr. C. W. Scott, D.F.C., and C. R. Robbins, D.F.C., M.C., of the Forest Department, both of whom had served in the R. A. F. during the war, were deputed for short periods to examine the photos and compare them with the actual types of forest on the ground. Both of these officers made trial flights over the area and visited parts of the forest.

Mapping from the photographs.—As soon as the prints were available the preparation of rectified mosaics and the compilation of the maps were undertaken by No. 18 Party (Aero-photo) Survey of India under Major Lewis in Maymyo. At the time of writing (August 1924) considerable progress has been made and it is hoped to complete the maps by November 1924.

Scale of maps.—At first it was arranged that the maps should be compiled on a scale of 4 inches = 1 mile. The actual scale of the photos proved to be about 3·4 inches = 1 mile and it was

agreed to alter the final scale to 3 inches = 1 mile as it was considered that this scale was sufficient for all purposes and was easier to work up the rectified mosaics, from which the final map would be compiled, to this scale.

Stock-mapping.—The final stock-mapping of the whole area must await the completion of the maps. The lines on which the stock-mapping can be carried out have already been determined and will be fully described in the reports written by Messrs. Scott and Robbins which will be published in a special bulletin. From their reports it is clear that no less than eight to ten different types of forest can be distinguished on the photographs and it is even possible to distinguish between fully stocked *kanazo* forest and the same forest that has been heavily worked. It is probable that a further comparison of the photos with the actual forests will indicate to a certain extent the quality of the growth of the *kanazo* forest.

Summary of results.—Although the results of the aerial survey from each point of view will be given in the special bulletin shortly to be issued, a short summary from the Forest Department point of view is given here—

1. *Cost.*—The cost including ground work and mapping has worked out at about Rs. 293·7 per sq. mile. A ground survey would have cost in the neighbourhood of Rs. 500 per sq. mile.

2. *Rapidity.*—The actual survey was completed in 5 months and the whole period taken from the commencement of the fixing of the ground control to the completion of maps and stock-maps should not greatly exceed one year. Ground survey would have taken 3 to 4 years.

3. *Accuracy.*—This is far in excess of anything that could have been obtained by ground survey in this type of country except at a further increase in cost and time.

4. *Details available.*—The areas and distribution of the different types of forests are not only obtainable at no increase of cost but with an accuracy that it would have taken years and a considerable expenditure to have equalled.

At the same time it must be remembered that this operation has been carried out over a country and type of forest that cannot be compared with the usual country and type of forest over the greater part of Burma and India. In the first place, the country is absolutely level. No trouble was therefore experienced with regard to hills and contours. In the second place the forest is of a special type and the more valuable type is characterised by a predominance of one species of most distinctive colouration and appearance.

It can by no means be proved from the success of this operation that aerial survey and exploration can be applied to hilly country or to different types of forest with equal success. Unfortunately it was not found possible owing to the delayed start to carry out a thorough series of experimental flights over different types of forest on the hills, and the single flight over the Pegu Yomas in Insein Division was vitiated by the time of year (April) when not only was visibility poor but the trees and bamboos with few exceptions were leafless and in such a state did not show any of their usual characters. (A description of this flight with conclusions is given in Mr. Scott's note.) Proposals have been placed before the Local Government to allow of a further season's work being carried out in the unexplored forests of South Tenasserim Division which cover over 14,000 sq. miles and are urgently in need of examination. These proposals have been accepted and will allow of a thorough trial of air exploration and photography in different types of forest on hilly country which will be of the greatest interest and benefit in making a full trial of the use of aeroplanes in forest mapping and exploration.

Utility of aerial survey of cultivated areas.—In conclusion here is one point that has been brought out very strongly in the course of this aerial survey and that is the extraordinary clearness of field boundaries on cultivated land. During the course of the work several photographs were taken of areas under cultivation. In rice cultivation every field is surrounded by a *kazin* or earth bund to hold up the water level. These bunds show up most

distinctly and as they form the boundaries between different fields and ownerships the utility of a survey of cultivated land can be amply proved.

H. R. BLANFORD, I.F.S.

THE CULTIVATION OF CONIFERS IN NORTHERN INDIA.

There appears to be very little on record regarding the successes and failures with cultivated plants in India with the result that the same species are tried over and over again. In the case of plants belonging to the Coniferæ, which often grow well without flowering, at any rate for very many years, identification becomes difficult so that in gardens such as the Botanic Gardens, Calcutta and Saharanpur, and the Agri-Horticultural Gardens, Lahore, there are conifers of which the genus only is known. There is usually no record as to the origin of the seed from which the plants were grown and the names if they have one at all often appear to have been invented by one of the *malis*.

Continuity appears to be extremely difficult to ensure in India, labels very soon become illegible or mixed or stolen so that in a few years a collection of conifers becomes a mass of unnamed plants and one has to wait till they flower in order to be able to identify them.

During the last few years efforts have been made to get together a representative collection of conifers for the Arboretum at the New Forest Research Institute and although there are no plants more than 3 years old a good many results have emerged, and if claims to success cannot be made with much confidence in many cases, the failures have often been quite definite.

Conifers in cultivation vary very greatly, some grow quite well in a climate altogether different to that of their homes whereas others appear to be much more particular. These differences seem to be more or less generic so that from the behaviour of one or two members of a genus one can get a fairly good idea as to what the rest will do.

Podocarpus.—Pilger in Das Pflanzenreich admits 55 species, some have since been described so that there are over 60 species in the genus. I believe that at least half of these and perhap all could be grown in Dehra Dun. Hitherto only two species are at all commonly cultivated in India and a third *P. neriifolius* D. Don is listed for the Botanic Gardens, Calcutta. *Podocarpus macrophyllus*, D. Don, subsp., *maki* usually known in India as *P. chinensis*, Wall., was probably introduced in 1811 from China to the Botanic Gardens, Calcutta, where it has been cultivated ever since. This species is a native of Japan and grows well in Calcutta, Saharanpur and Lahore. In Upper India only the male plant is in cultivation. It is propagated by cuttings which root fairly readily with *Podocarpus*. *Podocarpus elongatus* was introduced from the Cape in 1799 to the Botanic Gardens, Calcutta, where it was growing in 1842 but had apparently never flowered, It does not appear to exist in Calcutta now. There is a specimen in Dehra Dun of what appears to be this species though as far as I know it has never flowered. It is a healthy straight tree 32 feet high by 2 ft. 2 in. girth. This tree is probably about 35 years old as in the Dehra Dun herbarium there is a sheet showing the leaves only collected by Mr. Gamble in 1893 with the note "Podocarpus introduced from the Cape." The tree was doubtless planted by Mr. Gamble. This species is also grown in other gardens in Dehra Dun as well as in Saharanpur and it is propagated by cuttings. I have kept the name *P. elongatus* as it is fairly certain that this species is the one usually called by this name in S. Africa where all the Podocarps have for years been known by names that it is now believed do not belong to them and great confusion has been caused by recent attempts to alter the nomenclature. Similarly with seed recently received from S. Africa I have kept the names supplied with the seed and shown in brackets the latest names proposed.

We now have seedlings of the following species growing well in Dehra Dun:—

Podocarpus elongatus.—Seed supplied by the S. African Forest Department. (Probably *P. falcatus*, R. Br.)

Podocarpus falcatus.—Seed from S. African Forest Department. (Probably *P. Henkelii*, Staf.)

Podocarpus gracilor Pilger. Seed from the Forest Department, British East Africa.

Podocarpus pedunculatus Bailey. Seed from the Botanic Gardens, Brisbane = *P. amarus*, Blume fide Pilger.

Podocarpus thunbergii.—Seed from the S. African Forest Department. (Probably *P. latifolius*, R. Br.)

Seed of the Podocarps germinates very freely if the seed is fresh but it does not keep well so that several other species we have tried have failed to germinate. The young seedlings are vigorous and do not suffer in any way from the constant rain during the monsoon.

Araucaria.—Seward and Miss Ford in Phil. Trans. Royal Soc., Lond., Vol. 198 (1906), p. 317 et seq., enumerate 11 species; Dallimore and Jackson, Handbook of the Coniferæ, omit two of these but add one making 10 species. The members of this genus appear to be very particular in their requirements. One species *A. imbricata*, Pav., is temperate and is probably quite unsuitable for low elevations. The only specimen I know in India is at Annandale, Simla, 6,000 ft. It is not growing particularly well and probably requires a more uniformly moist climate. All the rest might be expected to do well in Dehra Dun. Four species *A. Bidwillii*, Hook., *A. Cookii*, R. Br., *A. Cunninghamii*, Sweet, and *A. exelsa*, R. Br., are listed as growing in the Botanic Gardens, Calcutta, in 1913 and the two latter in 1842. Of these only *A. Cunninghamii* does well. *A. Bidwillii*, Hook., is growing well in Dehra Dun and ripens its seeds in some years. The seeds are much appreciated by squirrels or they would doubtless germinate under the trees. Germination is very peculiar, the food material from the cotyledons is withdrawn into a woody carrot-like structure produced some inches below the surface of the ground. The "woody carrot" so formed may remain dormant till the following spring or it may produce a leafy shoot without much delay. Young seedlings are sensitive to drought in Dehra Dun and require watering in the dry season. *A. Bidwillii* does not stand heat very well, a plant in Lahore died in a

hot spell after growing a few years but there is a fair specimen in Amritsar and also one in Simla at 7,000 ft.

A. braziliana, Rich., I have tried this species twice. The first batch of seedlings grew extremely well up to the rains when they gradually damped off. The second lot of seed was sown towards the end of the rains and most of the seedlings damped off at once. The germination is similar to that of *A. Bidwillii* and a few seedlings were delayed and did not appear above ground till the monsoon was almost over. These seedlings failed to survive the following monsoon.

A. Cunninghamii, Aiton. This species is the best of the genus for Northern India and is grown in Lucknow and Saharanpur and does fairly well in Lahore. In Dehra Dun it produces cones freely but very little of the seed appears to be fertile. I have so far failed to get any germination from local seed but have observed a natural seedling under the largest trees in Dehra

Araucarias should be grown from fresh seeds, if kept the seed soon loses vitality. They can also be rooted from cuttings but terminal shoots are necessary, taken from double or multiple leaders.

Callitris.—Baker and Smith—A research on the Pines of Australia admit 18 species in the genus. Maiden, For. Fl. N. S. W. II (1907), p. 30 *et seq.*, only admits 13 species. As far as I am aware no attempts have been made to grow the Australian Cypresses in Northern India previous to 1912 when several species were tried in Lahore and Saharanpur. In Lahore they proved unable to stand combined heat and damp and none ever survived the seedling stage. Plants taken to Lahore from Saharanpur soon became sickly and died. In Saharanpur results were better and there is or used to be a good specimen of *Callitris glauca*, R., Br., in the Botanic Gardens. In Dehra Dun there are at lest four specimens of *Callitris glauca*, R. Br., which are now about 14 years old and make very ornamental trees. They have just started to produce cones.

In our recent trials seed of several species from South Africa were tried and also four species from Australia of which only one *C. robusta* germinated. In all cases the seedlings suffered much from damp during the monsoon and many small plants planted

out died and had to be replaced. Seed of *Callitris tasmanica*, Baker and Smith from the Nilgiris has given perhaps better results but these seedlings also suffered much during the rains and as the seed was received quite fresh and in the cones it germinated very freely so that it is doubtful if the percentage of success is any better. As the species of *Callitris* was in many cases not known for certain and as only some 8 or 10 plants have reached the planting stage they were planted together without preserving the names in most cases so that until they fruit it will not be possible to say what species we have.

Callitris tasmanica has passed successfully through two monsoons and is growing well.

According to Nicholson, Dictionary of Gardening, *Callitris* may be grown from cuttings as however the only species he specifically mentions is not now considered to belong to this genus, it is not known whether the Australian Cypresses root sufficiently readily from cuttings to make this method of propagation of practical value for raising plants for ornamental purposes. Seed germinates very readily if fresh but does not seem to retain its vitality for long. Plants of this genus should be tried in the lower hill stations for ornamental planting as the seedlings would probably stand the damp of the rains better in a cooler climate than they do in the plains.

Tetraclinis.—A genus containing a single species, *T. articulata*, Masters more commonly known as *Callitris quadrivalvis*, Vent. The only specimen I know in Northern India is one in Lahore. It is growing very well and makes an ornamental cypress-like tree. Fresh seeds from this tree germinate freely but they are very susceptible to damp and consequently the tree is likely to remain rare in cultivation in the plains. It is indigenous to N.-W. Africa and would probably do well in the hills at moderate elevations. So far attempts to grow it in Dehra Dun have failed as the seed has never germinated. As with the Australian Cypresses the seeds do not appear to retain vitality if kept.

Widdringtonia.—A genus containing 5 species of shrubs and trees found on the mountains of S. Africa as far north

as Nyassaland. I do not think any are in cultivation in Northern India nor are they likely to do well but with conifers it is unsafe to assume anything without a trial. The largest species is *W. Whytei*, Rendle, from Nyassaland. Seed of this species germinated very well in Dehra Dun but the young plants suffered greatly during the rains. A considerable number have survived the monsoon though in a miserable condition. They do not look at all promising but it is always possible that when beyond the seedling stage they will stand the monsoon better. According to Voigt. Hort. Suburb, Calc, both *Widdringtonia cupressoides* Endl., and *W. juniperoides*, Endl., were in cultivation in Calcutta in 1842, the latter having grown for over 12 years without flowering. All the South African species would be worth a further trial.

(*To be continued.*)

R. N. PARKER, I.F.S.

RECENT DEVELOPMENTS IN THE PUNJAB IRRIGATED PLANTATIONS.

Since the post-war slump in the timber trade which has checked the development of our Himalayan forests, it has become more obvious that the irrigated plantations are one of the Punjab's best forest investments. In addition to those already being formed, of which the eventual area will be about 50,000 acres, the Punjab Government has agreed to provide a further 30,000 acres in the new Sutlej Valley canals area, and the Bombay foresters are manœuvring for ground in the Sukkar zone in Sind. As it is some years since a resume of this work appeared in your columns from the pen of Mr. R. N. Parker, it may be of interest to foresters throughout India to hear of the more recent developments.

Of the plantations now being formed, Daphar on the Upper Jhelum Canal is undoubtedly the most promising. Practically 2,000 out of the total of 7,000 acres are now afforested, and at the rate of about 350 acres per annum, will be finished in 1937. The balance of the unplanted land, as in Chichawatni and

Khanewal on the Lower Bari Doab Canal, is leased out for cotton cultivation, and the revenue thus obtained more than covers the cost of formation of the plantation.

One of our most promising plantations, Kotlakhpat, which had an area of 2,000 acres only 7 miles from Lahore, was unfortunately surrendered in 1922 to a Model Town Building Society for an old song. The Forest Department was paid some meagre compensation for the value of standing crops of 5 years of age and over, and the area has since been cut up in a wonderful maze of circular roads. So far, about 4 lakhs of rupees have been subscribed by the optimistic owners of land plots, but up to the present little has been seen of any buildings except the old forest bungalow, which is now to be a Gentlemen's Club. There is also to be a Leper Hospital and a Sewage Farm so no doubt the town will be a model one if it is ever finished.

But to return to forestry, it is interesting to see that the stoppage of watering during the last two years in Kotlakhpat has not affected the forest badly, for the water level is high (about 17 feet down) and most of the trees have succeeded in getting their roots down to it. On the other hand, the other plantations cannot be treated in this way with impunity. In Changa Manga the dry summers of 1920 and 1921 have taken a heavy toll of the forest. In those years the rainfall was 3·28 and 8·46 inches respectively, compared with an average of 13·98. The Ravi River failed, the canal supply suffered, and during those two years Changa Manga got 75 per cent. and 30 per cent. of the minimum defined in the canal agreement. Many compartments went unwatered for one year, some for two, and the result was that many areas died off. A recent stock survey showed that about 30 lakhs of cubic feet of wood was killed and much of this we have not yet been able to remove. The forest is littered with dead patches, the regeneration of which we cannot undertake until they come within the W. P. prescriptions of fellings, and meanwhile they are absolutely unproductive.

Similar shortages of water in the Punjab rivers and particularly in the Ravi, have occurred at frequent intervals, generally every 4th or 5th year, and we have no guarantees against future

shortages. Changa Manga, unlike the younger plantations, was started originally to use the surplus water on the "tail" of the Upper Bari Doab. The zamindari demands are now very much in excess of the average supply, and in dry years the plantation is the first to suffer as there is little or no surplus water to be had. It seems a very short-sighted policy, therefore, to have embarked on the addition of another 2,000 acres to the irrigated plantation. This Shahpurjand Extension was begun in 1921 when the land in question had previously been brought under cultivation to meet the war-time demand for extra food grains. It was leased out in 1922 on a 5 years' contract, on which the contractor hands back some 300 acres each year ready for *shisham* sowing, pays a merely nominal land revenue, and is paid for all the work he does such as root stubbing, and the digging of channels and trenches for afforestation.

The planting up of Shahpurjand had often been discussed previously, but it was always shelved owing to lack of water. In spite of a fresh agreement with the Canal Department in 1920 for a larger supply, this has not materialised, as the figures for total acreage watered during the last decade will show :—

1914-15...	10,664	1919-20...	9,506
1915-16...	10,767	1920-21...	4,637
1916-17...	13,075	1921-22...	7,060
1917-18...	12,823	1922-23...	9,658
1918-19...	8,893	1923 24...	10,472

Another interesting point in the canal agreement is the farcial method by which our Changa Manga water supply is measured. In theory we should get a depth of 2·5 feet of water on the irrigable area, *i.e.* 1,248 million cubic feet. The Canal Department does not deal in cubic feet but in "cusecs," cubic feet per second, so our supply is measured once daily by the canal gauger; the daily readings are multiplied by 24 × 60 × 60 to give a reading of cubic feet of water on the assumption that the water actually runs for 24 hours. In practice the forest channels are a useful "dump" for spare water and are opened at times to adjust the level in the main canal, generally in the early morning. The

gauge reading taken at 8 A.M., however, is accepted for the 24 hours and the error is multiplied by 86,400! Thus we find that with a season's total of 21,000 cusecs—1½ times our minimum estimate—in 1923-24 we have been able to irrigate the whole plantation once only.

In Daphar also the watering arrangements leave a great deal to be desired. When the plantation was started in 1919 the Canal Department promised to remodel the distributory from which Daphar gets its supply. We have now reached the end of 1924 and nothing has yet been done. The minimum supply per acre of forest is considerably larger than that for zamindari cultivation, and as each year the forest increases in size the difficulties of carrying on with the present supply become more marked. Fortunately the permanent water level here is fairly high, as it has risen from 50 to 28 feet since the Upper Jhelum Canal was opened and some of the older crops have benefited by this. The rainfall here is extraordinarily erratic, for instance this year Daphar got practically no rain whatever until the 1st September, when it got 12 inches in two days!

What is probably the worst ground which has yet been afforested in the irrigated plantations has been successfully stocked this year in Daphar. A slope of 1 in 40 with a sterile soil of coarse sand and "kankar" limestone nodules has been planted with "root and shoot cuttings" of *shisham*, and the water has been detained in the trenches by treating the slope as a series of terraces, with two or three short lengths of trench in each the water being drained as slowly as possible from higher to lower terraces. There are also some very bad "*chappars*"—the buffalo-wallow swamps of pre-irrigation days—which remain flooded for part of the year and dry out as hard as brick. These can only be stocked by ridging the ground to considerably above the normal drainage level. *Shisham*, however, is not happy in such places, and we are still looking for a more suitable species with some commercial future.

The future of *Eucalyptus* is still problematical as we have not yet found a method of growing it on a commercial scale without the prohibitive expenses of intensive nursery work and

fencing of the forest area. Recent experiments have shown that quicker results with *Eucalyptus* can be had by making "root and shoot cuttings" of some of the species, and by this means we may be able to establish a considerable area of *Eucalyptus* in the younger plantations. It is a much less hardy subject than *shisham*, which responds amazingly to the root and shoot pruning of transplants, and has thus made possible the stocking of many areas where sowings had failed in the past. Cuttings were first used in Chichawatni four years ago, and their success has in a way revolutionised the plantation work They require considerably less water in their first year than do sowings, and the regeneration work can be done from February to September where as sowings can only be made successfully in March to May.

There should also be a great future for bamboo in these plantations as the demand for them in the canal colonies is a large and ever-increasing one. An experimental plot of 2½ acres of bamboo transplants from seed established this year in Daphar will be watched with interest.

In these days when economy is everyone's warcry—or spook! the various attempts to reduce the heavy cost of establishing these plantations are interesting. The usual method, doubtless known to many of your readers, is to trench the area by hand labour, the trenches being ten feet apart and a foot square in cross-section, running along the contours, the water being brought from the main channel by a series of smaller channels running down the contour at intervals in each compartment. The cost of this work of trenching is Rs. 18 per acre; sowing Seed along the "berm" of the trench is Rs. 2 per acre and planting pruned cuttings 5 feet apart in the trenches is Rs. 4 per acre. Sowings as a rule, require a further Rs. 2 for weeding, but cuttings can generally get through without assistance. The obvious line of attack is to reduce the cost of trenching, and two separate methods have been evolved during the last year at Daphar. One is the introduction of ploughing to cut the trenches, and the other is the adoption of the cultivator's method of raising crops in small "*khets*" of levelled ground separated by ridges to hold the water

Both of these have become possible only since the ground was leased for cultivation, for the previous *rakh* jungle land was too irregular in level and too full of tree roots to permit of such innovations.

An experimental area of 7 acres was treated in July 1924 with ploughing, an ordinary heavy metal plough (Chittanooga type) being worked backwards and forwards in the same furrow both ways, thus cutting a trench with slightly sloping sides 10" broad at the bottom and 8" to 10" deep. This of course is slightly rougher than the trench cut by hand labour, and has to be cleared of debris by a man following the plough. Half of the area was sown and half planted with cuttings, and both methods compare very favourably with the *shisham* in the surrounding areas of hand-made trenches which were afforested at the same time. The slightly rougher ploughed trench however is really more suitable for planting than for sowing. This ploughing was done with ploughs borrowed from a neighbouring Grass Farm, and the cost of the ploughmen's wages, bullocks' feed, etc., worked out at Rs. 5 per acre with sowings and Rs. 7 with planting. The initial outlay for purchasing the necessary ploughs and extra bullocks would be very small considering the saving involved.

A compartment of 44 acres was stocked in March 1924 by making "*killabandi khets*" of $\frac{1}{4}$ acre each, the water being brought down channels 2′ × 1′ between each second row of *khets*. Cuttings were transplanted at 5 foot intervals in rows 10 feet apart, and the result after a full season's growth is really excellent, the average height being $3\frac{1}{2}$ feet and the success quite 98 %, while the neighbouring sowings which started out at the same time are still struggling under a heavy growth of grass and weeds. The cost of Rs. 3 per acre for making the channels and *bandhs* can be cut out in future by getting the cultivation lessee to make his *bandhs* according to our requirements for his cotton crops, so that the only expense will be Rs. 4 for planting the cuttings. This is probably the nearest approach to the "*taungya*" system which we can get in the irrigated plantations, and it can only be employed where the soil is good and the ground absolutely level. Weeding here has been quite unnecessary

as controlled grazing is possible after the plants have sprouted strongly. The actual amount of water required to establish this compartment was just 60% of that required for sowings on similar ground with hand-cut trenches.

The future development of the plantation work should therefore be along the lines of this *killabandi* work for all good level ground, and of ploughed trenches on poorer irregular areas.

In Tera, a small plantation started near Lahore in 1918, the trenches were originally dug 15 feet apart, as it was thought that the poor supply of water could be better conserved with trenches widely spaced. This has proved a doubtful innovation, for the rows of *shisham* have taken so long to form a canopy that the growth is poor, and the growth of "*kana*" grass, always a menace in these young plantations, has been particularly troublesome.

The sylvicultural system in Changa Manga is clearfelling on a 20-year rotation, leaving *shisham* standards for timber production where suitable trees have been saved from the ravages of the *shisham* fungus and the crowding out by mulberry. The regeneration of felled areas is generally complete from the growth of coppice shoots, rootsuckers, and natural seedlings, provided the area is retrenched and watered two or three times early in the next irrigation season. In the areas now being worked over, however, the old crop has been very badly affected by the drought of 1920-21 and the reproduction from coppice shoots and root-suckers is rather poor.

Some years ago retrenching was discontinued for several seasons and, as a rule, the regeneration obtained by merely flooding the felled area was fairly good. In the drought-affected areas, however, retrenching is absolutely necessary, and in others it is advisable in economising the water supply. Where retrenching cannot be done owing to the expense, the watering could be more efficiently done by making a series of "*bandhs*" and dividing the area into acre or ¼-acre plots. The cost of reopening the old trenches is Rs 12 per acre—a heavy capital charge on each new crop—but there is little likelihood of reducing this unless by employing some elaborate tractor plough which could ride over the numerous roots without cannoning into them. The

American "Bennett Ditcher" is advertised as being capable of doing this, and would be well worth a trial.

The question of the actual profit to be made from irrigated plantations is an important one, for local governments are naturally more amenable to arguments in favour of the economic value of plantations in the canal colonies when they see that they yield a handsome profit in revenue. The figures for the last decade in Changa Manga are as follows :—

	Revenue.	Expenditure.	Surplus.
	Rs.	Rs.	Rs.
1913-14	2,20,318	69,442	1,50,876
1914-15	2,18,551	75,473	1,43,098
1915-16	2,04,439	90,908	1,13,531
1916-17	2,18,971	88,446	1,30,525
1917-18	2,66,129	88,709	1,77,420
1918-19	3,55,679	80,201	2,75,478
1919-20	4,37,423	2,42,101	1,95,322
1920-21	4,19,738	3,13,863	1,05,875
1921-22	3,58,423	3,40,883	17,540
1922-23	5,00,662	2,73,811	2,26,851
1923-24	5,03,180	1,60,101	3,43,079

The Profit and Loss Account shows that the cost of formation had been cleared by 1913, so that the above surplus is a clear profit to Government. The large expenditure in 1919—1922 was chiefly due to the installation of a 2-ft. gauge steam tramway. The fact that last year's is the largest profit yet recorded is also due to the tramway, which under the Forest Engineer's guidance has become an infinitely more efficient and economical proposition than the other methods of bullock carts and 14 in. gauge bullock tramway, though the latter, which was bought secondhand some 43 years ago, is still lingering with us in spite of annual depreciation calculations!

As the new plantations should have practically no cost of formation to debit to them in future years, owing to the revenue derived from temporary cultivation leases of the unplanted area, they should yield at least Rs. 30 profit per acre from the time they

come into full bearing. It is proposed to lay down steam tramways for Chichawatni and Daphar during the next few years and the cost of these should be very much less than for Changa Manga where the Department has had to buy its experience.

Like all the other foresters we tried to find "a place in the sun" at Wembley, but probably the best advertisement for the wood of the plains plantation was the case of Uberoi's sports goods in the Punjab section. The sports manufacturer's trade at Sialkot, started by Sirdar Gandha Singh Uberoi about 25 years ago, is now one of the most flourishing trades in the province. Its chief demand is for "green" mulberry logs from which they use the white sapwood for the ring of the tennis racquet. The dry log is used for hockey sticks and the innumerable stumps and posts required for games sets. The price obtained for mulberry, which was only a few years ago a despised weed, is now considerably higher than that of *shisham*, the *bakain* (*Melia Azedarach*) which is coming in more each year in Changa Manga, has been adopted by the local people for many of their requirements, but from an economic as well as a revenue producing point of view *shisham* still holds the premier place.

From this brief resume of recent developments it will be seen that the originators of our Punjab plantation work certainly did not over-estimate its value and that there is a tremendous future for this branch of forestry in all the new centres of canal development.

R. MACLAGAN GORRIE, I.F.S.

IMPERIAL FORESTRY INSTITUTE UNIVERSITY OF OXFORD.
PROSPECTUS FOR 1924-25.

Scope of Work.—The work of the Institute will comprise (1) post-graduate training of probationers for the forest services and other qualified persons, (2) training of research officers in special subjects, and (3) provision of courses for selected officers already serving.

The Institute does not undertake to provide a general training in Forestry such as is given at Universities or other centres where this subject is taught.

*Admission of Students**.—Only persons falling within one or other of the following categories are eligible for admission to the Institute :—

(*a*) Those possessing a Degree in Forestry or a Diploma or equivalent certificate of having satisfactorily completed an approved course of training in Forestry, who have been selected as probationers for the higher branch of some forest service ;

(*b*) Graduates with honours in Science who desire to become specialists in some branch of work connected with Forestry ;

(*c*) Forest officers deputed by their Governments to attend courses with the view of bringing their professional knowledge up to date.

(*d*) Students of approved qualifications not included in the first three categories who are admitted on the recommendation of Overseas Governments.

(*e*) Students with a University training in Forestry who may wish to attend the Institute on their own account and at their own expense.

Applicants for admission should send their names, together with details of previous training and subjects which it is proposed to study, to the Director, Imperial Forestry Institute, Oxford.

Course of Study.—The course of study will normally extend over one academic year, beginning October, and will be made sufficiently elastic to serve the needs of individual students. In special cases a period of less than one year may be arranged.

The following general programme of work indicates the subjects which will be dealt with during the academic year 1924-25 :—

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*NOTE.—The rules regulating the admission of students are strictly enforced. Applications from forest officers in India, who may not be included in either of the categories *a*) to *e*), are likely to cause disappointment unless supported by recommendations from their Governments.

Michaelmas Term (8 weeks, October 10th to December 6th).

Silviculture—elementary; characters and requirements of forest trees of Western Europe. Forest Mensuration—elementary; measurement of trees and timber. Forest Botany—pathology (mycology). Forest Entomology—lectures and laboratory. Economics. Climatology. Forest Utilization—chiefly felling and conversion, and minor products. Surveying.

Christmas Vacation (December 7th to January 15th).

No regular tours. Special work arranged if required.

Hilary Term (8 weeks, January 16th to March 14th).

Silviculture—sowing, planting and tending operations (theoretical and practical), natural regeneration, silvicultural systems (lectures in preparation for Continental tours). Forest Mensuration—measurement of sample plots, preparation of yield tables. Forest Valuation. Structure and properties of wood. Forest Entomology—lectures and laboratory. Forest Utilization. Economics. Forest law. Engineering (drawing and construction).

Easter Vacation (March 15th to end of April).

Tours in Continental forests. Afforestation work in Great Britain.

Trinity Term (8 weeks, end of April to end of June).

Silviculture, tropical. Forest Mensuration—measurement of sample plots, preparation of yield tables. Forest Management, including working plans (theory). Forest Policy. Soils, including field work. Forest Botany—physiology of trees, systematic, ecology. Forest Entomology—field work. Engineering—drawing, surveying (field work, including road project).

Long Vacation (early July till about middle of September).

Tours in Continental forests. Preparation of forest working plans (field work and compilation).

Continental Tours.—These will be arranged in progressive order, preceded by special lectures on Continental systems during February and March. The Easter Vacation tour will be devoted to the simpler methods to be seen in France, while the Long Vacation will be occupied with more varied methods, as practised in Germany, Switzerland, and Austria. Officers on leave who

wish to revise their knowledge of Continental systems should arrange the date of their leave to fit in with the programme of Continental tours, and should give the Director at least one month's notice of their intention to join one of these tours.

Fees.—An inclusive fee of £75 will be charged for instruction at the Institute. If the course of studies extends over less than one year, the fees charged will be £25 per Term and £1 per week for tours in the Vacation. These fees will include all charges for instruction both at Oxford and on tour, as well as for the use of apparatus, materials, library, etc.; they will not include living and travelling expenses.

No fees will be charged to students deputed by the British Forestry Commission or the Colonial Office.

Expenses.—Living expenses at Oxford during Term are roughly estimated at from £3 10*s.* to £4 10*s.* a week. Expenses on the Continent vary considerably with locality and other factors but ordinarily living is, if anything, cheaper than in England.

Membership of the University.—Students of the Institute may, at their own discretion, become members of the University; particulars regarding admission, expenses, etc., are given in a pamphlet entitled *General Information Concerning Admission, Residence, etc.*, obtainable (post free 6½*d.*) at the Clarendon Press Depôt, High Street, Oxford.

GASOLENE SKIDDERS.

We have received from the Clyde Iron Works of Duluth, Minnesota, U. S. A., circulars dealing with the adaptation of the internal combustion engine to timber haulage. It has been a serious disadvantage in the existing types of steam skidding machines that they are all too cumbersome and heavy for work in India. Mr. McGiffert, the head of the Clyde Iron Works paid a visit to India a few years ago and set himself to devise hauling machinery better suited to our requirements.

Two distinct types of machinery are now available. The Clyde Gasolene Ground Skidder in three sizes, forty, fifty and seventy-five horse power, which may be mounted on wooden

skids on long steel skids or on a crawler type of tractor. The second type consists of the Clyde Skidding Attachment for Fordson Tractors.

The 50 H. P. skidder uses seven to nine gallons of petrol per day. Its weight is 10,000 pounds, without skids and the price 3,165 dollars f. o. b., Duluth. The Clyde Fordson skidder has advantages in mobility being readily moved on wheels or by sliding along the surface of the ground. The weight with haul-back drum is 3,200 pounds and the price 750 dollars f. o. b., Duluth both exclusive of the Fordson Tractor.

The petrol engine has hitherto been considered insufficiently flexible for work of this nature and it will be interesting to see whether the above adaptations can stand up to the work as well as the unsympathetic treatment which all machinery in India is subjected to.

A few circulars as well as a copy of Mr. McGiffert's forwarding letter are available in the office of the Forest Economist, Dehra Dun.

THE EMPIRE FORESTRY JOURNAL.

Empire Forestry has decided to fix its name as *Empire Forestry Journal*, and has made the effect retrospective by issuing indices to volumes I and II under the new title. Apropos of this we are reminded that the adjectival use of the words "forest" and "forestry" appears to be accompanied by a certain measure of misapprehension in India.

In the last number of the Journal of the E. F. A. (Vol. III, No. 7, July 1924) the majority of papers has been provided by forest officers in Africa, *viz :*

Afforestation of the White Nile Mud Flats (with *Acacia arabica*), by W. A. Davie ; Forestry in Tanganyika, D. K. S. Grant ; Impressions of South African Forestry, by J. Sutherland ; The Forests of South Africa, by C. C. Robertson ; Fires in the Pencil Cedar Forests of Kenya Colony, by N. V. Brasnett ; and The Men of the Trees, by R. St. Barbe Baker.

From Asia are two papers: The Burma Selection System, by H. C. Walker and Forest Reconnaissance, by F. W. Foxworthy.

Canada has two papers on the Pulp and Paper Industry, by Edward Beck and the Output from Canadian Forests in 1922.

Forestry in New Zealand is described by F. W. Foster.

Articles of British origin deal with the Imperial Forestry Institute, Oxford, Empire Timbers at Wembley (J. S. Corbett) and the Functions of Agent and Broker.

We note that an interesting photograph of the carved teakwood Buddhist shrine at the B. E. E. is erroneously described as "an exact reproduction of the Shwe Dagon pagoda," Rangoon.

EDITORIAL.

THE FIFTIETH VOLUME.

With the present number the *Indian Forester* completes its fiftieth volume; but it is not until July 1925 that full fifty years will have elapsed since its foundation.

The Journal owes its existence to the enterprise of Sir William Schlich (then Conservator of Forests, Bengal) and the late B. H. Baden-Powell (Officiating Inspector-General). Its first appearance was made in July 1875 as a quarterly magazine in which form it continued until the ninth volume, when, in January 1883, it assumed the title of a 'monthly magazine of forestry, agriculture, shikar and travel.'

The *Indian Forester* was in its early years edited by W. Schlich and J. S. Gamble from Darjeeling, their headquarters as Conservators of Forests, Bengal, but in 1882 the editorship was transferred to Dehra Dun in the hands of W. R. Fisher, then Deputy Director of the Forest School. Except for a short relapse to a bi-monthly issue about 1890, and on one or two minor occasions later, the magazine has been issued regularly each month from Dehra Dun for the last forty years. First printed by the Calcutta Central Press Company, then by the Civil Engineering College Press, Roorkee, and the Mafasilite Printing Works

Company, Mussoorie, the *Indian Forester* has been efficiently published by the Pioneer Press, Allahabad, since 1899.

Among the contemporaries of the *Indian Forester* at the time of its foundation were the *Transactions of the Scottish Arboricultural Society*, which ante-dated it by about ten years, and the *Journal of Forestry and Estates Management*, which first appeared in May 1877, but no longer survives. The Journal can probably claim to be the oldest independent periodical in the English language devoted primarily to forestry, and is acknowledged to be the mother of forestry literature in India.

Unlike many scientific periodicals, which are owned by societies and associations or are subsidised by Government departments, the *Indian Forester* is a private publication, owing its continued existence to the generosity of individuals and to the efforts of a board of management of variable constitution into which the official element has rarely intruded. Often on the verge of becoming a purely technical quarterly, or a scrap-book of extracts from other publications, or a frankly parochial chronicle it has survived all vicissitudes and developed a distinctive individuality.

How far this fulfils the hopes of its founders may be judged from their prologue....."Our object is to supply a medium for the inter-communication of ideas and the record of observations and experiments, as well as to catch all stray fragments of information, all *facts* and *data*, and supply the places of 'Notes and Queries' to the Forest Service generally." They looked to members of the Forest Service primarily to provide the essential copy, but also to "district, settlement, railway, and engineer officers," and to official sources—"we are suppliants at the threshold of every temple of Government." Their appeal to forest officers for contributions is direct and has lost none of its necessity with the lapse of time.. ... "Above all we want steady contributors," wrote Schlich and Baden-Powell. "Many forest officers feel and naturally so, that they have no time for writing. Others feel that they have no facility with the pen, and perhaps too modestly imagine they can do nothing to help... ..While every number ought to contain a fair proportion of leisurely written and detailed matter, that share of the work must necessarily be

handed over to those who have the gift for writing, and who have the necessary literary machinery in the shape of books of reference to assist them. But the only value of a periodical of this sort will not consist in its containing elaborate essays. A large portion of it should be devoted to 'Scraps' and to brief 'Notes and Queries.' Every forest officer who is worthy of the name keeps a note-book, and as some new fact or some new experience comes to his notice, or some 'happy thought,' tending to the facilitation of some portion of his work, flashes across his mind, he will make a rough note of it.....And here is *the* line for the forest officer who loves not the desk and blotting-paper. Send us in, then, rough and artificial, from your note-book jottings. A diamond, even uncut, is a diamond still; and even if we cannot always have a diamond, we can have a crystal, and that is a very good thing in its way... ..Literary merit or excellence of style is not looked for in such communications....."

While there are a few whose 'happy thoughts' are confined to their diaries and annual reports, we venture to assert that the modern forest officer is not the Barrie-baited inarticulate that the foregoing exhortation may suggest. He has plenty to say but his reluctance to entrust his literary efforts to the *Indian Forester* is often due to the counter-attraction of other fields of publicity, which this age of specialised journalism provides. The shikari and angler sends his tales of big heads and big fish to the sporting periodicals, the traveller his notes to the geographical magazines, the bird-man and the bug-hunter to the natural history journals, the investigator to the research bulletins, while not a few publish their own books.

Perhaps the palmiest days of the *Indian Forester* were in the first decade of the present century, when an annual volume of well over seven hundred pages was maintained for many years, an *embarras de richesses* that no editor has since encountered. In recent years the number of subscribers has much increased and our circulation has extended far beyond the borders of British India. This wider outlook has possibly facilitated the tendency for the *Indian Forester* to become in the eyes of the service a journal that one reads rather than writes.

The voice of enquiry is nevertheless still animate in those of our pages constituting the section 'Correspondence.' "Free, full, and unfettered discussion of every principle and practice is the very life of forest science and forest art" states the prologue of 1875. "That discussion it will be our endeavour to facilitate with all the means at our disposal. But this thing we will do—we will impress on ourselves and our contributors the absolute maintenance of courtesy and good temper in the thick of the hottest discussion, and we will banish from our pages everything that verges on personality or harshness of expression. Our criticism will be directed to measures, not men, to the opinion and utterances of the impersonal office, not to the thoughts and deeds of individuals."

In this enunciation of the editorial principles one catches the echo of the words of Laboulbène:—"J'engage donc tous à éviter dans leurs écrits toute personalité, toute allusion dépassant les limites de la discussion la plus sincère et la plus courtoise."

* * * * *

Fifty years is a period of variable significance. It is the major part of a man's life, the adolescence of a tree, an era for a nation, a passing moment in geology. For a magazine it is a ripe and venerable age, that few technical journals have reached. We should like to record in the number for July 1925 a worthy celebration of the Jubilee of the *Indian Forester*, but in that intention we are entirely dependent on the co-operation of our readers.

REVIEWS.

COMMON NAMES FOR INSECT PESTS.

REVIEW: PRELIMINARY CHECK-LIST OF COMMON NAMES USED IN APPLIED ENTOMOLOGY, by H. Morstatt, *Supplementa Entomologica*, Nr. 10, 1924, Price 2 Marks.

It appears to have been necessary for systematic entomologists to take the first steps to produce an index to the common names used for insect pests in the literature of economic entom-

ology. The check-list prepared by Dr. H. Morstatt and issued as a special number of the journal of the *Deutsches Entomologisches Institute*, Berlin, gives an alphabetical index of 56 pages to the English, French, German and Dutch names with their Latin equivalents. Such an index is badly needed, for many economic entomologists have the annoying habit of referring in their articles only to the popular name of an insect pest by which it is usually unrecognisable in other parts of the world.

In its present form the check-list is admittedly incomplete and of temporary value, but it is anticipated that an early revision will be undertaken, and that its scope will be extended to include brief data on the distribution of the pest and the form of injury due to it. With later revisions the editor, Dr. W. Horn, suggests that it may take the form of a Catalogue with references to synonyms and important literature, but we venture to think that such an elaboration is unnecessary in view of the pest—catalogues now in course of preparation by the Bureau of Entomology, London, and the Association of Economic Entomologists in America.

Popular names for insect pests are the natural outcome of conditions in countries speaking European languages, but in the Orient it is doubtful if they are an advantage. In India an English "common name" is as much an innovation as the Latin generic and specific names of the insect. When it is realised that there are 20 or 30 species of *Xyleborus* all ranking as shot-hole borers of *sal*, there appears to be no reason why Latin terms should not be adopted for popular use in forestry.

C. F. C. B.

CORRESPONDENCE.

[NOTICE.—Correspondents who wish their letters to appear in a particular number of the *Indian Forester* should ensure that they reach the Honorary Editor by the 15th of the previous month. Unless exceptionally long they will be inserted.]

THE NORMAL SAL SELECTION FOREST.

SIR,—I have been attacked in various quarters for having the audacity to propound a theoretical conception of the normal *sal* selection forest.

Mr. Howard starts out to deny that the diameter class distribution in a selection forest is the same as that for a uniform forest. I, on the other hand, accept the statement, until the contrary has been proved, that the silvicultural system employed makes no material difference to the theoretical conception of the normal forest.

What is the normal forest? According to Recknagel "it is a standard with which to compare an actual forest to bring out its deficiencies for sustained yield management, a forest with normal age classes, in size and distribution, normal increment and normal growing stock." The conception of a normal forest is a mere ideal, it is non-existent under any system of management and any controversy about the nature of this ideal is not likely to end in anything tangible.

M. Gurnaud who advocated the adoption of the selection system in France was unable to furnish incontrovertible evidence concerning the normal stocking of the selection forest. He failed to establish that the normal stocking of the selection forest is higher than that of the uniform forest. Indeed, the modern Swiss School headed by Biolley has as yet made no pretentions to an exact knowledge of what the normal growing stock under the selection system should be.

All I have done is to draw the curve of what to the best of my ability I consider to be the normal distribution of the diameter classes, taking as a basis the figures of Howard's *sal* yield table and assuming that what I have said above is true, that in effect the normal stocking of the selection forest and the uniform forest are identical for all practical purposes. In other words it is supposed that every acre of the selection forest has its own share of trees ranging from the smallest to the largest, mixed anyhow so that each acre under selection contains $\frac{1}{r}$ of the trees of all dimensions which would otherwise have been on r acres, each acre having trees of the same age. It is immaterial whether the diameter classes are mixed on one acre or grouped in even-aged groups on 100 acres the results so far as the curve is concerned will be the same. It is admitted that the selection system affords

the possibility of a larger number of trees per acre than the uniform system, on the obvious mathematical conception that it is possible to pack in a unit of area more trees of crowns of different sizes in different planes than trees with crowns of the same size in one plane. The probability of this conception being true in practical forestry is unfortunately very remote. The factors that are responsible for growth, the productivity of the soil, the activity of light and the supply of carbon dioxide, are practically constant for a unit of area. The claim that the supply of light and carbon dioxide is increased by having trees of different heights (*i.e.*, the selection forest) in a unit of area, is untenable; the vital factors of growth being constant, the chances of getting more trees in a unit of area under the selection system than under the uniform system are remote. The soil will be unable to support a number larger than the maximum (the normal).

In this conception I am in good company. Schlich states (page 227, Vol. III, Manual of Forestry):—

"The growing stock of a normal selection forest may be placed equal to that of a forest under the clear cutting system as all the age gradations are represented in a similar way though differently arranged over the area; hence it can be ascertained by summing up the quantities given in a yield table."

I will now proceed to show how the figures of the *sal* normal forest quality II have been obtained.

Taking the figures of Howard's *sal* yield table for even-aged forest of this quality, a curve can be drawn showing the relation between the age and the number of trees per acre (Curve 1, Plate 24). If the units on the age axis each represent one year, and those on the number of trees' axis each represent 5 trees, then the number of trees on one acre of uniform forest between the ages **A** and $\mathbf{A}_1$, will obviously be 5 times the number of squares between the age axis, the curve, and the verticals **A** and $\mathbf{A}_1$ or more accurately 5 times the number of square units of area within these 4 limiting lines. If a normal even-aged forest be considered with 1 acre under forest of each age up to the rotation age **r**, it follows that the total number of trees in the forest of

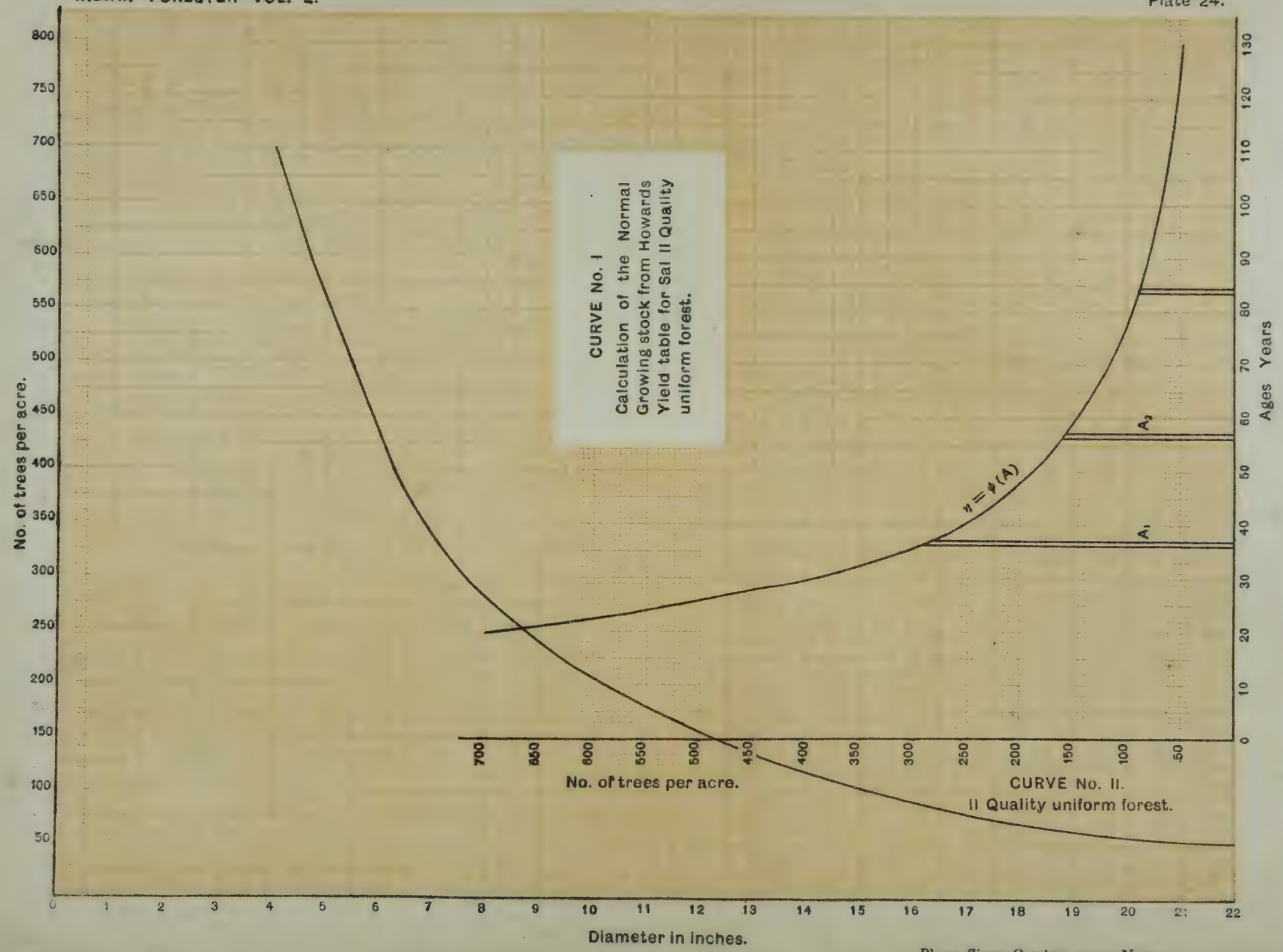

CURVE No. I
Calculation of the Normal Growing stock from Howards Yield table for Sal II Quality uniform forest.
No. of trees per acre.
Ages Years
Diameter in inches.
$y = \phi(A)$
A_1
A_2
No. of trees per acre.
CURVE No. II.
II Quality uniform forest.

Photo. Zinco. October, 1924.—No. 888.

acres, will be directly proportional to the area between the two axes of the curve, the curve itself, and the vertical at **r** and actually 5 times the number of square units.

Until it can be proved to the contrary, it is accepted that **r** acres of normal selection forest will have the same number of trees of each age, but completely intermingled equally in every acre.

Similarly the number **N** of trees in either of these normal forests between the ages A_1 and A_2 is proportional to the area between the verticals at A_1 and A_2, the age axis and the curve, which area can be obtained by planimeter or by counting up the squares, and they will occupy in each case an area of $A_2 - A_1$ acres. If now A_1 and A_2 are the ages corresponding to the diameters D_1 and D_2 limiting a selected diameter class (these figures are available in the yield table), **N** will be the number of trees in this diameter class in $A_2 - A_1$ acres of normal selection forest. In this way, points can be obtained permitting the drawing of a second curve (Curve 2, Plate 24) for the number of trees per acre against the diameter.

The number of trees of each diameter class per acre of normal selection forest can be taken direct from either of these curves in the way just described, and this is done for a rotation age **r** of 100 acres in the following table:—

Diameter class Inches.	Age in years.	Number of trees on 100 acres.	Number of trees per acre.
18—16	110—84	1,369	14
16—14	83—70	1,482	15
14—12	69—57	1,788	18
12—20	56—46	1,992	20
10—8	45—37	2,205	22
8—6	36—28	3,234	32
6—4 —	27—19	5,303	53
	Total ...	17,373	174

All this can be expressed in mathematical symbolism by the following equation, the result of integration between the limits A_1 and A_2 of the equation $n = \phi(A)$ connecting the number of trees per acre with the age of the (uniform) crop :—

$$N = \int_{A_2}^{A_1} \phi(A).\, dA$$

Incidentally there is an error in the published yield tables. In curve No. 7 the number of trees is wrongly entered and the mistake is perpetuated on page 22 where the number of trees at the age of 20 years is not 780 but 680.

So far I have dealt with the theory. I have constructed a theoretical normal standard curve with which to compare the actual growing stock. This is the only thing of any importance so we will now examine the facts disclosed.

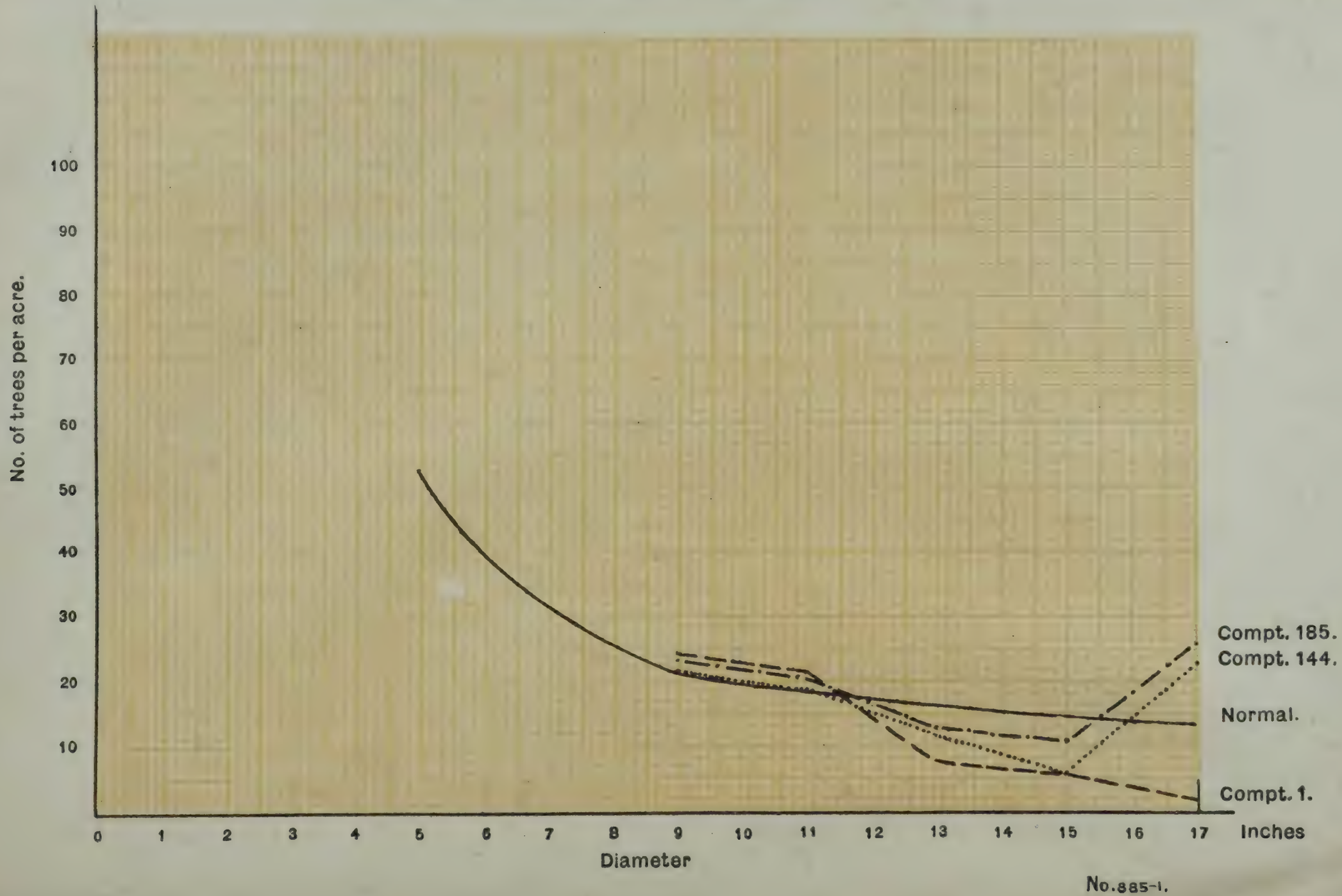
The graph No. 3, Plate 25, shows the normal number of trees per acre for the diameter classes 4″—6″ ; 6″—8″ ; 8″—10″ ; 10″—12″ ; 12″—14″ ; 14″—16″ ; 16″—18″ at the arithmetical mean diameters 5″ ; 7″—11″ .....17″. This normal curve can be used as a standard for comparison of the actual growing stock of various compartments. For example, by plotting the curves for compartments 1,185,144 of North Kheri Division, it is clear that compartment 1 is in excess in diameter classes up to 12″ and is deficient from 12″ onwards. Similar conclusions can be drawn from compartments 144,185 and this is all that was ever intended and to anyone who has to mark a selection felling in any compartment such a graph cannot but be a useful guide in showing how the marking should bear on the various diameter classes if the object of marking is to obtain a selection forest approaching more nearly to the normal however hypothetical this may be.

Mr. Howard denies that my curve of the normal forest is of any practical utility so we will now investigate the description of these compartments prepared without any reference to this controversy.

No 3

THE STANDARD NORMAL CURVE

SAL SELECTION II QUALITY.



No.885-1.

Comptt. No.	*Description of the growing stock.*	Quality class.
1	The crop is dense poles and saplings in which the saplings predominate, forming patches and strips throughout the area. Most of the older trees have now been removed and dense regeneration has come up in all blanks. There are a large number of young *asna* mixed with the *sal*, these two forming almost the entire crop.	II But as the crop as a whole is not mature the stand is generally below the minimum height of this Quality class.
144	The forest crop is confined to the north-eastern half of the compartment and is situated wholly on the high level. The crop is mixed *sal* and *asna* in the usual proportions. Both species are present in excess in the pole and sapling stage, but all classes are fairly well represented. Old and useless trees must be removed, even by departmental working as they are hampering the young crop, and it is to be feared that if girdled they will be attacked by ficus, and ultimately carry a denser crown than at present.	II
185	The crop is similar to that in compartment 176(*b*) but the congested pole crop gives way to a sapling crop in a similar stage of congestion along the north western boundary. The density of the crop is not so high in the western end	II
176(*b*)	The crop is generally similar to that in compartment 172(*d*) but as there is a slight undulation running across the compartment the *sal* in the depression is not so dense as on the slightly higher levels where it forms a fairly dense pole crop over most of the area. Older trees are more numerous in proportion to the younger age classes than generally found on the high ground.	II
172(*d*)	The crop is almost pure *sal*, *asna* being generally scarce and occupies almost one-half of the compartment, the remainder being open grass land. All age classes are present, but there is a preponderance of poles, more specially in the north.	II

I would now ask the reader to compare these descriptions with curve No. 3 showing how the growing stock in these compartments differs from what I have taken as the normal. It will be observed that the curves follow the descriptions very closely, that in C. 1 there is an absence of big trees and a dense pole crop, in C. 144 excess of young stock, fair representation of medium and again excess of old stock. In C. 185 all age classes

are represented with a preponderance of poles and older trees are more numerous than generally found. My normal curve therefore shows quite correctly the abnormalities of stocking disclosed in the description of compartments and I have no reason to be dissatisfied with it. It answers the purpose for which it is used and is of practical utility and this is all I require of it, whether it satisfies Mr. Howard or not is a matter of indifference to me.

C. G. TREVOR, I.F.S.

SUGAR-CANE IN TAUNGYAS.

SIR,—In the September issue of the *Indian Forester* Mr. Trafford asks for information as to the cultivation of sugar-cane as a field crop in *taungyas*.

Sugar-cane was introduced as a field crop in the regeneration areas in Thindawyo Reserve in Tharrawaddy Division, Burma, five years ago. This reserve is situated in the plains, is surrounded by paddy fields and is consequently very wet, water lying for many months throughout the rains. The new area is staked out 6′ × 6′ and at the time of, or shortly after, transplanting the tree seedlings, the cane is planted in the line of stakes. When the cane shoots have grown to a height of about 2′, the earth is gradually heaped up along the lines, care being necessary that the seedlings are not buried (where an individual seedling is very small a small hollow is left round it).

Mr. Trafford does not say whether the locality he refers to is semi-inundated. In the case of Thindawyo it would be impossible to grow the sugar-cane as he describes in between the staked lines, as the result of heaping up the earth round the cane would be the formation of a trench in which the water would lie several inches deep and where it would be impossible for any seedling to keep alive.

Cultivation is carried on for three years in the same area. The first crop of cane is cut at 1-year old and this, and the second year's crop, are the most prolific of the three, an annual outturn of about 3,000 to 5,000 canes per acre being expected.

The disadvantage of the 3-year cultivation is that the tree seedlings have to put up with a lot of suppression, modified, however, by the removal two or three times a year of the lower leaves of the cane—an operation beneficial also to the growth of the latter.

It is still too early to say what results we shall get from the forest point of view. *Dwani* (*Eriolaena Candollei*), *yemane* (*Gmelina arborea*), Andaman *pyinma* (*Lagerstroemia hypoleuca*), Andaman *padauk* (*Pterocarpus dalbergioides*), *thitpayaung* (*Nauclea excelsa*) and *taukkyan* (*Terminalia tomentosa*), are the principal species at present growing with the cane, and of these *yemane* is the only one which up to now has got its head above the cane.

E. F. A. HAY, I.F.S.,
Tharrawaddy Division.

VON MANTEL'S FORMULA.

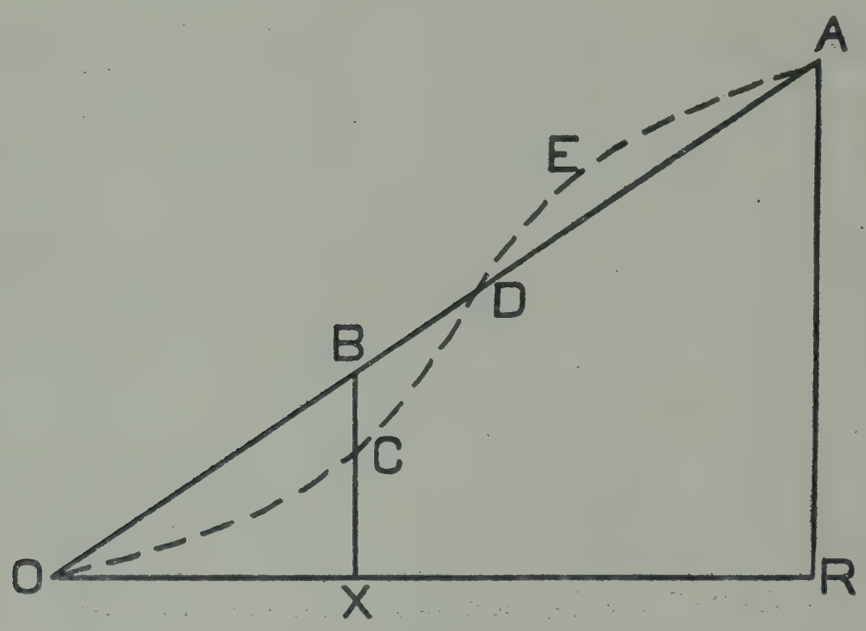
SIR,—I should feel much obliged if you could find room for the appended note in the next issue of the *Indian Forester*.

von Mantel, on taking charge of the Bavarian State forests, nearly a century ago, found himself confronted by a large area of State forests, for which the sustained yield had to be fixed. Presumably influenced by the Austrian Assessment Method, he decided to fix the yield in the course of one rotation as a temporary make-shift, at twice the volume actually existing in a forest thus obtaining the average annual yield by the formula $Y = \frac{2V}{r}$ where **V** represents the actual volume and **r** the rotation. von Mantel was quite aware that the method gave only approximately correct results, but it served his purpose until the collection of further data enabled the department to introduce a more accurate method.

The method has of late years been taken up in India. I may mention that I used the principle of it myself in when regulating the 1882 yield of the Gumpahar forest in Darjeeling, without knowing anything whatever of von Mantel's formula. Lately several of my old friends have attempted to modify von

Mantel's formula with a view to making it more accurate and to adapt it to local condition, but it seems to me that they have made matters rather worse than better, and I hope they will reconsider the subject in the light of the following remarks :—

All the new formulas are based on the assumption that the plotted values of the volumes of a normal series of age-gradations form a straight line. This is not the case ; they form a curve for which no algebraic formula has been discovered. Gustav Heyer submitted the case 60 years ago to the late Dr. Klebsh, a famous Professor of Mathematics, and I placed it before my old friend the late Professor Minchin, but the thing could not be done. It has to be dealt with by graphic representation. Taking, for instance, the data for Silver Fir I quality, on page 372 of Volume III of my Manual of Forestry, and plotting the volumes over the diameters, a graph is obtained of about the appended form—



Here the interrupted line is the upper edge of the graph representing the volume of a series of age-gradations, and not the straight line, the hypotenuse of the triangle **AOR**, In adapting von Mantel's formula to the requirement of the United Provinces the volume produced during the first **X** years is represented by my friends by the triangle **BOX** and that produced during the rest of the rotation by the triangle **ABXR** ; whereas they are in

reality **COX**, and **AEDCXR**, respectively. Consequently the new formulas have been constructed on a wrong basis, however ingenious their conception may be. They introduce an additional source of inaccuracy in the determination of the yield of the forest.

But apart from what I have stated above, it seems to me that my friends have gone out of the way to create unnecessary difficulties. It is the practice in the United Provinces only to enumerate and calculate the volume of trees of 8 inches diameter and upwards. Why not reason as follows :—These trees have been produced during the last rotation, and as about double that quantity is ordinarily produced in one rotation, we are justified in removing twice the stock of trees over 8 inches diameter during the next rotation and yet leave at the end of it the same quantity as that present at the beginning. Here you have von Mantel's formula pure and simple as a makeshift for a moderate period of time. Really accurate determinations of the yield can be secured in the case of irregular forests *only* by periodic remeasurements, say after 10 years in the first place and somewhat longer intervals afterwards. In that way we ascertain the actual increment by the simple formula—

Periodic Increment Ip = Vn + Yp − Vo.

Where **Vn** = Volume at the end of the first period, **Yp** the quantity removed during the period, and **Vo** the volume present at the commencement of operations. The value obtained by this formula is the basis upon which the yield of the next period is determined. This should be done in the spirit of the Austrian, or Heyer's method, that is to say : If the growing stock at the end of the first period is fairly normal (by which I mean fairly in accordance with the objects of management), then the full increment should be removed ; if it is below that standard then less than the increment should be cut until the normal growing stock has been established ; if it is above that standard, more than the actual increment may be cut until the growing stock has been reduced to the normal amount.

W. SCHLICH.

Oxford, 30th September, 1924.

DOMESTIC OCCURRENCES.

BETROTHAL.

The engagement is announced between Thomas M. Coffey, Imperial Forest Service, third son of P. M. Coffey, Ballinacree, Knocklong, Co. Limerick and Isobel Anderson Graham, second daughter of the Rev. J. A. Graham, D.D., C.I.E. Kalimpong, Bengal.

MACKENZIE.—On October 19th, 1924 at 6, The Circus, Bath, England, to the wife of J. M. D. Mackenzie, I.F.S., a daughter."

GAZETTE NOTIFICATIONS.

1.—Gazette of India.

17th December 1923.—No. 214-C.—On return from leave Mr. B. O. Coventry, F.C.H., Conservator of Forests, is posted to the Punjab, with effect from the forenoon of the 22nd November 1923.

19th December 1923.—No. 229-C.—Consequent on his departure on leave, Mr. E. A. Symthies, Officiating Conservator of Forests, United Provinces, reverted to the class of Deputy Conservators of Forests, with effect from the afternoon of the 21st November 1923.

Mr. C. G. Trevor, Deputy Conservator of Forests, is appointed to officiate as Conservator of Forests in the United Provinces, with effect from the afternoon of the 13th December 1923.

2.—Bengal Gazette.

4th December 1923.—No. 11118 *For.*—Babu Surendra Kumar Datta, Extra Assistant Conservator of Forests, Bengal, is granted leave on average pay under Rule 81 (*b*) (*ii*) of the Fundamental Rules, on medical certificate, for two months and nine days, with effect from the 14th October 1923, in extension of the leave granted to him in Government Notification No. 9722 For., dated the 5th October 1923.

3.—Bihar and Orissa Gazette.

10th December 1923.—No. 21-*Forests.*—Mr. B. P. Basu, Assistant Conservator of Forests, is posted to the Sambalpur division as an attached officer with headquarters at Sambalpur.

Mr. M. L. Sen Gupta, Assistant Conservator of Forests, is posted to the Puri Division as an attached officer with headquarters at Puri.

14th December 1923.—No. 22-*Forests.*—On return from leave, Mr. E. R. Comber, Extra Assistant Conservator of Forests, remained attached to the Chaibasa Forest Division for the 25th October 1923.

29th December 1923.—No. 25-*Forests.*—Maulvi Dilawar Hussain Khan, Extra Assistant Conservator of Forests, employed as Assistant Working Plan Officer, is appointed to act temporarily as Working Plan Officer in place of Mr. P. J. Phillip in addition to his own duties, with effect from the 8th December 1923.

4.—Assam Gazette.

Nil.

5.—United Provinces Gazette.

15th December, 1923.—No. 60.—Lala Ram Sarup I, Extra Assistant Conservator of Forests, attached to the North Kheri Forest division in the Eastern Circle, is transferred to the South Kheri Forest Division in the same Circle as an attached officer.

20th December 1923.—No. 61.—Mr. J. Stephens, who has been appointed by the Secretary of State to be an Assistant Conservator of Forests, is posted to the North Kheri Forest Division in the Eastern Circle as an attached officer.

6.—Punjab Gazette.

13th December 1923.—No. 29457.—The following posting is made with effect from the date specified :—

Mr B. O. Coventry, Conservator of Forests, is posted to the charge of the Western Circle, Punjab, with effect from 22nd November 1923 (forenoon) on return from 13 months combined leave and relieving Mr. R Parnell, Officiating Conservator of Forests, transferred to the Utilisation Circle, Punjab.

20th December 1923.—No. 29957.—Mr. Neter Parkash Mohan, B.A , Assistant Conservator of Forests, attached to the office of the Chief Conservator of Forests, Punjab, is posted to Kangra Forest Division as an attached officer, with Headquarters at Dharmsala, with effect from 30th November 1923 (forenoon).

3rd January 1924.—No. 204.—In column 3 of the Punjab Government Notification No. 26647, dated the 14th November 1923, relating to the transfer of Mr. W. H. G. Samler, Assistant Conservator of Forests for " Kalesar " *read* " Simla."

5th January 1924.—No. 330.—Mr. J. Singh, Assistant Conservator of Forests on deputation to the Suket State, is attached to the Office of the Chief Conservator of Forests, Punjab, with headquarters at Lahore with effect from 22nd November 1923 (forenoon), on reversion from the Suket State where he made over charge of his dutie on the afternoon of the 13th November 1923.

No. 355.—Mr. Sundar Singh, Assistant Conservator of Forests, is attached to the office of the Chief Conservator of Forests, Punjab, with effect from 7th December 1923 (afternoon). He has been newly appointed by His Majesty's Secretary of State for India. Reported arrival at Bombay on 30th November 1923 (forenoon).

Mr. A. M. David, Assistant Conservator of Forests is attached to the office of the Chief Conservator of Forests, Punjab, with effect from 11th December 1923 (forenoon). He has been newly appointed by His Majestys' Secretary of State for India. Reported arrival at Bombay on 30th November 1923 (afternoon.)

No. 370.—Khan Sahib Allah Bakhsh, B.A., Assistant Conservator of Forests, attached to the office of the Chief Conservator of Forests, Punjab, is posted to Hoshiarpur Forest Division, as an attached officer, with headquarters at Hoshiarpur, with effect from 9th December 1923 (afternoon).

7.—Central Provinces Gazette.

8th December 1923.—No. 4975-2899-III.—The unexpired portion of the combined leave granted to Rai Sahib Laiq Singh, Extra-Assistant Conservator of Forests, in Order No. 183-12-III, dated the 14th January 1922, is cancelled with effect from the 1st January 1922, and he is granted instead, with effect from that date, leave on average pay for six months and seventeen days, combined with leave on half average pay for seven months and eight days, under Fundamental Rules 81 (*b*) (ii) and the proviso thereunder and 87 (*a*).

Orders No. 339-111-III, dated the 24th January 1923, and No. 2403-1172-III, dated the 4th June 1923, are hereby cancelled.

No. 4978-2756-III.—Mr. G. B. Baksi, who has been appointed, by His Majesty's Secretary of State for India, to the Imperial Forest Service as Assistant Conservator of Forests and allotted to the Central Provinces, is posted as an attached officer to the Nimar Forest Division.

12th December 1923.—No. 5047-3044-III.—Mr. C. G. Hobday, Extra-Assistant Conservator of Forests, is recalled to duty compulsorily from the leave granted to him by Order, No. 4254-2479-III, dated the 24th October 1923, and is posted to the Bilaspur Forest Division.

No. 5048-3044-III.—On relief by Mr. Hobday, Mr. W. J. Anthony, Extra-Assistant Conservator of Forests, in charge of the Bilaspur Division, is transferred in the same capacity to the Balaghat Division.

No. 6019-3080-III.—Mr. G. B. Bakshi, who has been appointed, by his Majesty's Secretary of State for India, to the Imperial Forest Service as Assistant Conservator of Forests and allotted to the Central Provinces, is posted to the Melghat Forest Division.

Order No. 4928-2756-III, dated the 8th December 1923, is cancelled.

2nd January 1924.—No. 9-3-III.—Mr. Dhanraj Dutt, Extra Assistant Conservator of Forests, attached to the South Raipur Forest Division, is appointed to officiate as Divisional Forest Officer and is posted in charge of the Seoni Forest Division, *vice* Mr. W. G. Gilmore proceeding on leave.

No 37-2484-III.—Under Rule 81 (*b*) (i) and the note thereunder and Rule 87 of the Fundamental Rules, leave on average pay for ten months and on half average pay for a further period up to the 30th August 1925, is granted to Mr. W. G. Gilmore, Divisional Forest Officer, Seoni Division, with effect from the date on which he is relieved of his duties.

8.—Madras Gazette.

11th December 1923.—No. 326.—Mr. W. C. Hart, Extra Assistant Conservator of Forests, is granted an extension of leave on average pay on medical certificate for three months in continuation of the leave already granted to him.

Under rule 81 (*c*) of the Fundamental Rules, Mr. S. K. Basu and Mr. M. K. Nair, Assistant Conservators of Forests, are granted leave not due on half average pay from 12th November 1923 to 10th December 1923 and from 12th November 1923 to 5th December 1923 respectively.

15th December 1923.—No. 327.—Mr. C. R. Ranganathan, appointed by the Secretary of State to the Indian Forest Service, reported his arrival at Bombay on the forenoon of the 30th November 1923.

22nd December 1923.—Under rule 81 of the Fundamental Rules, M. R. Ry. K. G Belliappa Avargal, Extra Assistant Conservator of Forests, is granted leave on average pay for two months from 3rd January 1924 with permission to prefix the Christmas holidays.

Under rule 81 of the Fundamental Rules, M. R. Ry. S. V. Devadasan Avargal, Extra Assistant Conservator of Forests and District Forest Officer, Chingleput, is granted leave on average pay for six weeks from 3rd January 1924.

M. R. Ry A. Hanumantha Rao Avargal, Extra Assistant Conservator of Forests, Tinnevelly, is posted to be in charge of the Chingleput district during the absence of M. R. Ry. S. V. Devadasan Avargal, on leave.

3rd January 1924.—Mr. B. K. Roy, Deputy Conservator of Forests and District Forest Officer, South Cuddapah, is granted extension of leave on average pay for thirteen days from 21st November 1923 to 3rd December 1923.

Under rule 81 of the Fundamental Rules, Mr. R. S. Browne, Assistant Conservator of Forests, South Coimbatore Division, is granted leave on average pay for twenty-four days from or after 2nd February 1924.

9.—Bombay Gazette.

18th December 1923.—No. 3235.—Mr. T. K. Mirchandani, Extra Assistant Conservator of Forests and Sub-Divisional Forest Officer, Dangs, transferred to North Thana to supervise the work in connection with the construction of the grass storage shed at Palghar, took charge of his duties on 13th December 1923 in the afternoon.

10—Burma Gazette.

8th December 1923 —No. 258.—On completion of the special duty to which he was posted in this Department Notification No. 208, dated the 11th October 1923, Mr. H. E. Flint, Assistant Conservator of Forests, is transferred from Mandalay and reposted to duty in the Shwebo Forest Division.

10th December 1923.—No. 259.—Mr. C. E. Milner, Deputy Conservator of Forests, has been granted by His Majesty's Secretary of State for India an extension of leave on half average pay for ten days in continuation of the leave granted to him in this Department Notification No. 236, dated the 15th November 1923.

11th December 1923.—No. 260.—Maung Ba Zan, Extra Assistant Conservator of Forests, on probation, attached to the Mandalay Depôt Division, is transferred from Mandalay and posted to duty in the Thaungyin Forest Division.

No. 261.—Mr. G. Aubert, Extra Assistant Conservator of Forests, on probation, attached to the Shwebo Forest Division, is transferred from Kanbalu and posted to duty in the Mu Forest Division, with effect from the 1st December 1923.

No. 262.—On return from leave, Mr. W. A. Robertson, Deputy Conservator of Forests, is placed on special duty in the office of the Conservator of Forests, Utilisation Circle.

14th December 1923.—No. 266.—On completion of the special duty in the North Toungoo Forest Division, to which he was posted in this Department Notification No. 172, dated the 25th July 1923, Mr. J. W. R. Sutherland, Assistant Conservator of Forests, is transferred from Toungoo and reposted to duty in the Pyinmana Forest Division.

15th December 1923.—No. 267.—Mr. G. F. Ball, Deputy Conservator of Forests, has been granted by His Majesty's Secretary of State for India an extension of leave on half average pay on medical certificate for two months in continuation of the leave granted to him in this Department Notification No. 202, dated the 28th September 1923.

17th December 1923.—No. 268.—Under the provision of Rules 80 and 81 of the Fundamental Rules, leave on average pay for eight months and in continuation thereof leave on half average pay for one year and one month, for a total period of one year and nine months, is granted to Mr. A. W. Moodie, Deputy Conservator of Forests, in charge of the Delta Forest Division, with effect from the 2nd January 1924 or the subsequent date on which he avails himself of it.

No. 269.—Mr. E. H. Peacock, Extra Assistant Conservator of Forests, attached to the Delta Forest Division, is placed in temporary charge of that Division in place of Mr. A. W. Moodie, Deputy Conservator of Forests, proceeding on leave.

No. 270.—Prior to his assumption of duties as Revenue Assistant in the Tharrawaddy Forest Division, to which he was posted in this Department Notification No. 248, dated the 24th November 1923, Maung Ni, Extra Assistant Conservator of Forests, was attached to that Division.

18th December 1923.—No. 271.—On return from leave, Mr. C. W. Scott, Deputy Conservator of Forests, is posted as Instructor (Major), Burma Forest School, in place of Mr. C. Lindsay-Smith, Extra Assistant Conservator of Forests, transferred.

No. 272.—On relief by Mr. C. W Scott, Deputy Conservator of Forests, Mr. C. Lindsay-Smith, Extra Assistant Conservator of Forests and Instructor, Burma Forest School, is transferred from Pyinmana and posted to the charge of the Delta Forest Division in place of Mr. E. H. Peacock, Extra Assistant Conservator of Forests, who remain ttached to that Divisio .

No. 273.—Mr. George Willian Murray Woods who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted on arrival to the headquarters of the Maymyo Forest Division of the Central Circle.

Mr. Woods reported his arrival in Rangoon on the 13th December 1923, before noon.

No. 274.—Mr, George Dungate Warwick, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted on arrival to the headquarters of the Zigon Forest Division of the Hlaing Circle.

Mr. Warwick reported his arrial in Rangoon on the 13th December 1923, before noon.

No. 275.—Mr. Philip Meyrick-Jones, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted on arrival to the headquarters of the Tharrawaddy Forest Division of the Hlaing Circle.

Mr. Meyrick-Jones reported his arrival in Rangoon on the 13th December 1923, before noon.

No. 276.—Mr. Edward Quinton O'Brien-Smith, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted on arrival to the headquarters of the South Pegu Forest Division of the Sittang Circle.

Mr. O'Brien-Smith reported his arrival in Rangoon on the 13th December 1923, before noon.

No. 277.—Mr. Harold Vincent Tollemache, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted on arrival to the headquarters of the Katha Forest Division of the Northern Circle.

Mr. Tollemache reported his arrival in Rangoon on the 13th December 1923, before noon.

No 278.—Mr. Richard John Sayers, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted on arrival to the Working Plans Circle, with headquarters at Prome.

Mr. Sayers reported his arrival in Rangoon on the 13th December 1923, before noon

No. 279.—Mr. Frederick George Burgess, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted on arrival to the headquarters of the Pyinmana Forest Division of the Central Circle.

Mr. Burgess reported his arrival in Rangoon on the 13th December 1923, before noon.

No. 280.—Mr. Thomas Charles Donald Ricketts, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted on arrival to the Working Plans Circle, with headquarters at Moulmein.

Mr. Ricketts reported his arrival in Rangoon on the 13th December 1923, before noon.

No. 281.—Mr. Kenneth MacColl, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted on arrival to the headquarters of the North Toungoo Forest Division of the Sittang Circle.

Mr. MacColl reported his arrival in Rangoon on the 13th December 1923, before noon.

2nd January 1924.—No. 2.—Mr. Arthur Neal Barker, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted, on arrival, to duty in the Working Plans Circle, with headquarters at Maymyo.

Mr. Barker reported his arrival in Rangoon on the 24th December 1923, forenoon.

No. 3.—Mr. Hedley Herbert Crawford Pudden, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant

Conservator of Forests, is posted, on arrival, to the headquarters of the Shwebo Forest Division of the Chindwin Circle.

Mr. Pudden reported his arrival in Rangoon on the 24th December 1923, forenoon.

No. 4.—Mr. Edward Clare Simmons, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted, on arrival, to special duty in the Hlaing Circle.

Mr. Simmons reported his arrival in Rangoon on the 24th December 1923, forenoon.

No 5.—Mr. Paul Noel Humphrey Garnett, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted, on arrival, to the headquarters of the Prome Forest Division of the Hlaing Circle.

Mr. Garnett reported his arrival in Rangoon on the 24th December 1923, forenoon.

No. 6.—Mr. Donald Edmund Belford Manning, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted, on arrival, to the headquarters of the Ataran Forest Division of the Tenasserim Circle.

Mr. Manning reported his arrival in Rangoon on the 24th December 1923, forenoon.

No. 7.—Mr. William Henderson Osborne, who has been appointed by His Majesty's Secretary of State for India to the Imperial Forest Service as Assistant Conservator of Forests, is posted, on arrival, to the headquarters of the Mu Forest Division of the Chindwin Circle.

Mr. Osborne reported his arrival in Rangoon on the 24th December 1923, forenoon.

3rd January 1924.—No. 8.—The Government of Burma (Ministry of Forests) promotes Maung Ba (3), and Maung Pya Rangers, first grade, to be Extra Assistant Conservators of Forests, on probation, with effect from the 1st November 1923.

No. 9.—Mr. F. Pemberton, Forest Engineer, attached to the Ataran Forest Division, is transferred from Moulmein and posted to duty in the Utilisation Circle, with headquarters at Rangoon.

No. 10.—Mr. L. R. Fletcher, Forest Engineer, attached to the Insein Forest Division, is transferred from Insein and posted to duty in the Ataran Forest Division, with headquarters at Moulmein, in place of Mr. F. Pemberton, Forest Engineer, transferred.

LIST OF BOOKS AND PUBLICATIONS RECEIVED BY THE HONORARY EDITOR DURING THE MONTHS OF DECEMBER 1923—JANUARY 1924.

The Review of Applied Entomology, Series A : Agricultural, and B : Medical and Veterinary, Vol. XI, Part II, November 1923.

Revue des Eaux et Forets, Vol. LXI, No. 11, November 1923.

Index to the Proceedings of the Madras Legislative Council, Third Session, September 1922—April 1923, Vols. VIII—XIV.

Report on Forest Administration in the Shan States previous to Federation for the half-year ending 30th September 1923.

The Timber Trades Journal, Vol. XCIV, Nos. 2465, 2466, 2467 and 2468, dated 24th November, and 1st, 8th and 15th December 1923.

The Madras Forest College Magazine, Vol. VIII, No. 2, December 1923.

A method for the accurate determination of carbonic acid present as carbonate in soils—Agricultural Research Institute, Pusa, Bulletin No. 151 of 1923.

The Australian Forestry Journal, Vol. VI, No. 11, November 1923.

C. Leary and Company's London Market Reports, 1st to 30th November 1923.

Journal of Forestry, Vol. XXI, No. 6, October 1923.

Transactions of the Royal Scottish Arboricultural Society, Vol. XXXVII, Part II, November 1923.

Indian Engineering, Vol. LXXIV, Nos 25 and 26, dated 22nd and 29th December 1923, and Vol. LXXV, Nos 1 and 2, dated 5th and 12th January 1924.

The Tropical Agriculturist, Vol. LXI, No. 5, November 1923 and No. 6, December 1923.

Sylva, No. 4, April 1923.

Records of the Geographical Survey of India, Vol. LIV, Part 4, 1923.

Annual Progress Report on Forest Administration in the Province of Bihar and Orissa for the year 1922-23.

Allahabad : —Printed and Published at the Pioneer Press, by C. G. HARRIS,
No. 1965—1-2-24.

GAZETTE NOTIFICATIONS.

1.—Gazette of India.

9th April 1924.—No. 30.—Consequent on the grant of leave to Mr. F. A. Leete, C.I.E., Chief Conservator of Forests, Mr. C. B. Smales, Conservator of Forests, is appointed to officiate as Chief Conservator of Forests, Burma, with effect from the afternoon of 12th March 1924.

Mr. W. A. Robertson, Deputy Conservator of Forests, is appointed to officiate as Conservator of Forests, in Burma, with effect from the afternoon of 24th March 1924.

No. 31.—Consequent on his departure on leave, Mr. C. H. Philipp, Officiating Conservator of Forests, in Burma, reverted to the class of Deputy Conservators of Forests, with effect from the afternoon of 24th March 1924.

10th April 1924.—No. 33.—Consequent on the retirement of Mr. J. C. Hopwood, Conservator of Forests, Burma, (on leave) Mr. C. G. Trevor is confirmed as Conservator of Forests, United Provinces, with effect from the 17th March 1924.

15th April 1924.—No. 74.—Mr. S. R. Rao, who has been appointed by His Majesty's Secretary of State for India to the Indian Forest Service is appointed Assistant Conservator of Forests, in the Madras Presidency, with effect from the 14th February 1924.

2. Mr. Harish Chandra Khanna, Assistant Conservator of Forests, Madras Presidency, is transferred to the Punjab, with effect from the afternoon of the 20th March 1924.

21st April 1924.—No. 92.—Consequent on the grant of leave to Mr. E. R. Stevens, Conservator of Forests, United Provinces, Mr. H. L. Cooper, Deputy Conservator of Forests, Assam, is appointed to officiate as Conservator of Forests in the United Provinces, with effect from the afternoon of 11th April 1924.

22nd April 1924.—No. 95.—In the Notification of this Department No. 480, dated the 11th March 1924, *for* "2 Mr. R. I. MacAlpine" *substitute* "2. Mr. R. I. Macalpine."

23rd April 1924.—No. 101.—Mr. Rameshwar Banerjee, Extra Assistant Conservator of Forests, Bengal, is appointed to be an Assistant Instructor at the Forest Research Institute and College, Dehra Dun, with effect from the afternoon of the 15th April 1924.

From the same date the services of Mr. R. N. De, Extra Assistant Conservator of Forests, Assam, are replaced at the disposal of the Government of Assam.

No. 103.—Mr. H. R. Blandford, O.B.E., Deputy Conservator of Forests, Burma, is appointed to officiate as Conservator of Forests in Burma, with effect from the afternoon of the 3rd April 1924.

24th April 1924.—No. 105.—Mr. D. R. S. Bourke, Deputy Conservator of Forests, Bombay, made over charge of his duties as Instructor at the Forest Research Institute and College, Dehra Dun, on the afternoon of the 31st March 1924 and his services have, with effect from the forenoon of the 1st April 1924, been placed at the disposal of the Foreign and Political Department for employment under the Government of Siam.

No. 107.—Consequent on the grant of leave to Mr. B. O. Coventry, Conservator of Forests, Mr. R. N. Parker, officiating Conservator of Forests and Officiating Forest Botanist at the Forest Research Institute and College, Dehra Dun, is transferreed for employment as Officiating Conservator of Forests in the Punjab, with effect from the afternoon of the 10th April 1924.

From the same date Mr. S. H. Howard, Silviculturist at the said Institute, is appointed until further orders to hold charge of the Botanical Branch in addition to his own duties.

30th April 1924.—No. 125.—Consequent on the grant of leave to Dr. J. L. Simonsent, Forest Chemist, Forest Research Institute and College, Dehra Dun, Dr. Jatindra Nath Sen, Supernumerary Agricultural Chemist at the Agricultural Research Institute, Pusa, is appointed to officiate as Forest Chemist, Forest Research Institute and College, Dehra Dun, with effect from the forenoon of the 15th April 1924.

During the period 11th April 1924, the date on which Dr. Simonsen proceeded on leave, and the 14th April 1924, both days inclusive, Mr. W. F. Perree, President, Forest Research Institute and College, Dehra Dun, held charge of the Chemical Branch of that Institute in addition to his own duties.

No 127.—In the Notification of this Department No. 455, dated the 6th March 1924 *for* "15 Mr Sukumar Sen Chaudhri" *substitute* "15 Mr. Sukumar Chaudhri".

No. 130 —Consequent on the grant of leave to Mr R. C. Milward, Conservator of Forests, Bengal, Mr. J. Homfray, Deputy Conservator of Forests, is appointed to officiate until further orders as Conservator of Forests, Bengal, with effect from the afternoon of the 16th April 1924.

No. 132.—Consequent on the retirement of Mr. R. S. Troup, C.I.E., Conservator of Forests, Burma, (on leave) Mr. F. Canning is confirmed as Conservator of Forests, United Provinces, with effect from the 13th April 1924.

7th May 1924.—No. 158.—Consequent on the grant of leave to Mr. J. W. Bradley, Chief Forest Officer, Andamans, Mr. L. Mason, B.A., O.B.E., M.C., Deputy Conservator of Forests, Central Provinces, is appointed to officiate as Chief Forest Officer, Andamans, with effect from the afternoon of the 12th April 1924.

No. 160.—Mr. F. C. Osmaston, Assistant Conservator of Forests, Bihar and Orissa, is appointed to be an Instructor at the Forest Research Institute and College, Dehra Dun, with effect from the forenoon of the 29th April 1924.

2.—Bengal Gazette.

24th March 1924.—No. 12-*For.*—On relief of the charge of his duties as Instructor, Bengal Forest School, on the forenoon of the 16th March 1924, Babu Rameswar Banerji, Extra Assistant Conservator of Forests, is transferred to the Jalpaigur, Division for working-plan duty with headquarters at Jalpaiguri.

25th March 1924.—No. 31-*For.*—Babu Paresh Nath Mukharji, Extra Assistant Conservator of Forests, attached to the Sundarbans Division, is posted to the charge of that Division, with effect from the 19th March 1924.

27th March 1924.—No. 14-*For.*—In supersession of this office Notification No. 11-For., dated the 20th April 1923, Mr. L. E. S. Teague, Deputy Conservator of Forests, is placed on special duty in the Chittagong, Chittagong Hill Tracts and Cox's Bazar Divisions, with effect from the 7th April 1923, with headquarters at Chittagong. He will be entitled to draw the local allowance sanctioned for the officers in the Chittagong Hill Tracts for the dates on which he may actually work in that Division.

29th March 1924.—No. 15-*For.*—Mr E. A. C. Modder, Deputy Conservator of Forests, Darjeeling Division, is transferred to the Buxa Division as an attached officer, with effect from the 15th April 1924 or subsequent date with headquarters at Buksa Duar. He will take over charge of that division with effect from the 1st May 1924 or subsequent date with headquarters at Buksa Duar, *vice* Mr. A. K Glasson, Deputy Conservator of Forests, proceeding on leave.

No. 16 *For.*—Mr. F. J. A. Hart, Depty Conservator of Forests, attached to the Darjeeling Division, is posted to the charge of that division, with effect from the 15th April 1924 or subsequent date with headquarters at Darjeeling, *vice* Mr. E. A. C. Modder, Deputy Conservator of Forests, transferred.

No. 17-*For.*—Mr. J. Homfray, Divisional Forest Officer, Jalpaiguri Division, is transferred to the Direction Division, as an attached officer on special duty, with effect from the 11th April 1924 or subsequent date with headquarters at Darjeeling.

No 18-*For* – Mr. D. A G Davidson, Assistant Conservator of Forests, attached to the Jalpaiguri Division, is posted to the charge of that Division, with effect from the 11th April 1924 or subsequent date with headquarters at Jalpaiguri, *vice* Mr. J. Homfray, Deputy Conservator of Forests, transferred to the Direction Division.

4th April 1924.—No 19-*For.*—Mr M A T. Marchant, Extra Assistant Conservator of Forests, on special duty, in the Chittagong Division, is transferred to the charge of the Cox's Bazar Division with headquarters at Cox s Bazar.

No. 20-*For.*—On relief by Mr M A T. Marchant, Extra Assistant Conservator of Forests, of the charge of the Cox's Bazar Division, Babu Jatindra Nath Bose, Extra Assistant Conservator of Forests, is transferred to the charge of the Chittagong Division with headquarters at Chittagong.

No. 21-*For.*—On relief by Babu Jatindra Nath Bose, Extra Assistant Conservator of Forests, of the charge of the Chittagong Division, Mr. S. J Curtis, Deputy Conservator of Forests, is transferred to the charge of the Sundarbans Division with headquarters at Khulna.

No 22-*For.*—On relief by Mr. S. J. Curtis, Deputy Conservator of Forests, of the charge of the Sundarbans Division, Babu Paresh Nath Mukharji, Extra Assistant Conservator of Forests, is posted as an attached officer to the Sundarbans Division with headquarters at Khulna.

10th April 1924.—No 23-*For*—Babu Sachindra Nath Mitra, Extra Assistant Conservator of Forests, on special duty is posted to the charge of the Kumargramduar Forest sub-division in the Buxa Division from the 1st April 1924 with headquarters at Kumargramduar.

12th April 1924.—No. 24-*For.*—On relief of the charge of the Apalchand Range, Jalpaiguri Division, Mr C. K. Homfray, Assistant Conservator of Forests, is placed on working plan duty in the Jalpaiguri Division with headquarters at Jalpaiguri, with effect from the afternoon of the 5th April 1924.

No 25-*For.*—Babu S K Basu, Extra Assistant Conservator of Forests, is allowed leave on average pay for one month and six days, under Article 81 (*b*) (*ii*) of the Fundamental Rules, with effect from 10th February 1924.

3.—Bihar and Orissa Gazette.

9th April 1924.—No. 5-*For*—Maulvi Dilawar Hussain Khan, Extra Assistant Conservator of Forests, did the work of a Range Officer in the Singhbhum Division from the 17th to the 20th March 1924 in addition to his own duties as an Assistant Working Plan Officer. He was relieved of the duties of Assistant Working Plan Officer with effect from the 21st March 1924, when he reverted to the Singhbhum Division (now called Saranda Division), as an attached officer.

23rd April 1924.—No. 6-*For.*—Mr. C. M Chaudhri, Assistant Conservator of Forests, attached to the Sambalpur Forests Division, is placed in charge of that Division, *vice* Mr A. H H. Ross, Assistant Conservator of Forests, granted leave.

25th April 1924.—No. 7-*For.*—Babu Indu Bhusan Mukharji, Extra Assistan Conservator of Forests, in charge of the Santal Parganas Forest Division is allowed, under Article 260 of the Civil Service Regulations, privilege leave for 28 days, with effect from the 5th May 1924.

No. 3666—IIIF-1113-R.—Mr. W. G. C. Breakey, Extra Assistant Conservator of Forests, is granted leave for eighteen months, *viz.*, leave on average pay out of India and Ceylon for eight months and leave on half average pay for the remaining period under Fundamental Rules 77 and 81, with effect from the 1st April 1924 or any subsequent date on which he may avail himself of it.

30th April 1924.—No. 8-*For.*—Mr. W. D. M. Warren, Assistant Conservator of Forests, attached to the Porohat Forest Division, is transferred to the Saranda Forest Divison, as an attached officer.

4.—Assam Gazette.

31st March 1924.—No. 716-R.—Mr. W. Meiklejohn, Deputy Conservator of Forests, Assam, is granted leave on half average pay for two days, under Rule 81 of the Fundamental Rules, in extension of the leave granted in Notification No. 2510R., dated the 15th October 1923.

No. 717R. On return from leave, Mr. W. Meiklejohn, Deputy Conservator of Forests, Assam, is attached to the Khasi and Jaintia Hills Division.

No. 718R.—Mr. W. Meiklejohn, Deputy Conservator of Forests, is transferred from the Khasi and Jaintia Hills and appointed to hold charge of the Sibsagar Forest Division.

16th April 1924.—No. 885R.—Babu Chandra Sekhar Purkayastha, Probationary Extra Assistant Conservator of Forests, is confirmed in the Assam Forest Service, with effect from the 22nd March 1924.

No. 886R.—Srijut Parasuram Datta, Probationary Extra Assistant Conservator of Forests, is appointed as supernumerary Extra Assistant Conservator of Forests, with effect from 22nd March 1924.

24th April, 1924.—No. 903R.—Srijut Deveswar Barua, Extra Assistant Conservator of Forests, is granted combined leave for one month *viz*, leave on average pay for twelve days and leave on half average pay for the remaining period, under Rule 81 of the Fundamental Rules, in extension of the leave granted by the Conservator of Forests, Assam, in his Notification No. 1-26-P.F.G.O., dated the 26th February 1924.

5.—United Provinces Gazette.

19th April 1924.—No. 7.—Lala Hukam Chand, Extra Assistant Conservator of Forests, attached to the Chakrata Forest Division in the Western Circle, held charge of that Division from 14th March to 5th April 1924, both days inclusive.

No. 8.—Mr. G. M. Hopkins, Assistant Conservator of Forests, in charge of the Ramnagar Working Plan Division in the Working Plan Circle, is transferred to the charge of the Chakrata Forest Division in the Western Circle.

25th April 1924.—No. 9.—M. Manzur Ahmad Kakazai, on appointment as Extra Assistant Conservator of Forests, is posted to the South Kheri Forest Division in the Eastern Circle as an attached officer.

No. 10.—Lala Raghubans Sarup Agarwal, on appointment as Extra Assistant Conservator of Forests, is posted to the Silviculture Division in the Working Plan Circle as an attached officer.

No. 11.—Pandit Suresha Nand Nautiyal, on appointment as Extra Assistant Conservator of Forests, is posted to the Kalagarh Forest Division in the Western Circle as an attached officer.

28th April 1924.—No. 12.—Notification No. 25, dated the 2nd August 1923, granting three months' leave to Mr. G. K. Murphy, Extra Assistant Conservator, is cancelled.

No. 446/XIV-119.—Mr. G. O. Coombs, Deputy Conservator of Forests, South Kheri Division, is granted leave on average pay for five months, with effect from the 15th May 1924.

30th April 1924.—No. 462/XIV-213.—Mr. H. G. Billson, M.L.C., Chief Conservator of Forests, United Provinces, is appointed to hold charge of the Utilisation Circle in addition to his own duties during the absence on leave of Mr. F. Canning, Officiating Conservator of Forests.

6.—Punjab Gazette.

9th April 1924.—No. 11051.—Lala Prem Nath, Assistant Conservator of Forests, is posted to Upper Bashahr Forest Division (Eastern Circle) as Divisional Forest Officer, with effect from 23rd March 1924 (forenoon) on return from leave.

No 11058.—Mr. Harish Chandra Khanna, Assistant Conservator of Forests, is posted to Kangra Forest Division Eastern Circle) as an attached officer with Headquarters at Dharmsála, with effect from 20th March 1924 (afternoon), on transfer from Madras.

No. 3.—Bhai Dalip Singh, Extra Assistant Conservator of Forests, on probation, attached to the Jhelum Forest Division, is transferred to the new Depôt West Division, as Divisional Forest Officer with effect from the forenoon of 1st April 1924.

14th April 1924.—No. 11576.—Mr J. Singh, Assistant Conservator of Forests, attached to the Lahore Forest Division (Western Circle) is transferred to Foreign service in the Jubbal State as Working Plan Officer, with effect from 14th March 1924 (afternoon).

No. 11579.—Mr. H. M Glover, Deputy Conservator of Forests in charge of the Rawalpindi West Forest Division (Western Circle is granted 8 months' leave on average pay including privilege leave for 1 month and 9 days) combined with 4 months' leave on half average pay under Rule 81 of the Fundamental Rules with effect from 1 th March 1924 (afternoon), on relief by Khan Fazal Muhammad Khan, Assistant Conservator of Forests

No. 11580.—Khan Fazal Muhammad Khan, Assistant Conservator of Forests, attached to the office of the Chief Conservator of Forests, Punjab, is transferred to Rawalpindi West Forest Division (Western Circle) as Divisional Forest Officer, with effect from 18th March 1924 (afternoon), relieving Mr. H. M. Glover, Deputy Conservator of Forests, proceeding on 1 year's combined leave.

No 12972.—Mr B. O. Coventry, Conservator of Forests, Western Circle, Punjab, is granted 7 months' leave on average pay under Rule 81 of the Fundamental Rules, with effect from 15th April 1924 (afternoon), on relief by Mr R. Parnell, Officiating Conservator of Forests.

No. 12973.—Mr R Parnell, Officiating Conservator of Forests, in charge, Utilisation Circle, Punjab is transferred to Western Circle, Punjab, with effect from 15th April 1924 (afternoon) relieving Mr B. O. Coventry, Conservator of Forests, proceeding on leave.

No. 12974.—Mr R. N Parker, Forest Botanist, Dehra Dun, United Provinces, is appointed Officiating Conservator of Forests, Utilisation Circle, Punjab, with effect from 15th April 1924 (afternoon) relieving Mr. R Parnell, transferred to the charge of the Western Circle, Punjab.

29th April 1924.—No. 5.—Lala Shiv Dayal, Extra Assistant Conservator of Forests, in charge of the Depôt East Division (Utilization Circle), transferred to Upper Bashahr Division (Eastern Circle as an attached Officer, with headquarters at Nichar, with effect from 16th April 1924 (forenoon) on relief by Lala Uttam Chand Extra Assistant Conservator of Forests, transferred from the Upper Bashahr Forest Division.

3rd May 1924.—No. 6.—Khan Muhammad Khan, Extra Assistant Conservator of Forests, attached to the Direction Division, Hazara, N. W. F Province transferred to Depôt West Division (Utilisation Circle) as an attached officer, with headquarters at Wazirabad, with effect from 25th April 1924 (forenoon)

3rd May 1924.—No. 7.—Khan Muhammad Khan, Extra Assistant Conservator of Forests, attached to the Depôt West Division (Utilisation Circle), posted to the charge of the Depôt West Division (Utilization Circle), with headquarters at Wazirabad, with effect from 28th April 1924 (afternoon).

5th May 1924.—No. 8.—Mian Udey Singh, Extra Assistant Conservator of Forests, on probation, attached to the Seraj Forest Division who was granted 3 months' leave on average pay in the Chief Conservator of Forests, Punjab's Notification No 29, dated the 13th February 1924, returned from leave on the afternoon of the 21st April 1924. The unexpired portion of leave from 22nd to 30th April 1924 is hereby cancelled.

No 9.—Mian Udey Singh, Extra Assistant Conservator of Forests on probation, is posted to Seraj Forest Division (Eastern Circle) as an attached officer, with headquarters at Kulu, with effect from 21st April 1924 (afternoon) on return from leave.

7.—Central Provinces Gazette.

23rd April 1924.—No. 1637-875-III.—*Erratum.*—In Order No. 1161-503-III, dated the 31st March 1924, relating to the reversion to his substantive appointment of Assistant Conservator of Forests in the North Chanda Division of Mr Syed Abdul Wahid, *add* at the end after the words "that Division" the following:—"as Assistant Working Plans Officer."

28th April 1924.—No. 1724-869-III.—Under Rule 81 (*b*) (*i*) of the Fundamental Rules leave on average pay for six months is granted to Mr. G M. Townshend, Divisional Forest Officer, South Mandla Forest Division, with effect from the 7th May 1924, or the subsequent date from which he avails himself of it.

No. 1725-869-III.—Mr. G M Wilford, Extra Assistant Conservator of Forests, in charge of the North Mandla Forest Division, is appointed to hold charge of the South Mandla Forest Division temporarily, in addition to his own duties, *vice* Mr. G. M. Townshend, granted leave, or until further orders.

5th May 1924.—No. 1816-408-III.—Mr. Muhammad Ismail, Extra Assistant Conservator of Forests, attached to the Balaghat Forest Division, is appointed to officiate as Divisional Forest Officer and is posted in charge of the Amraoti Forest Division.

No. 1817-408-III.—On relief by Mr Muhammad Ismail, Rai Sahib Laiq Singh, Extra Assistant Conservator of Forests, in charge of the Amraoti Forest Division, is transferred in the same capacity to the charge of the Seoni Forest Division.

No. 1818-408-III.—On relief by Rai Sahib Laiq Singh, Mr. Dhanraj Dutt, Extra Assistant Conservator of Forests, in charge of the Seoni Forest Division, is transferred in the same capacity to the charge of the South Raipur Forest Division.

8.—Madras Gazette.

4th April 1924.—Under Rule 81 of the Fundamental Rules, M.R.Ry. B A. Cariappa, Probationary Extra Assistant Conservator of Forests, is granted leave on average pay for 16 days from 1st April 1924.

2. He will be permitted to affix the Easter holidays provided the conditions laid down in the subsidiary rules under Fundamental Rule 68 are fulfilled.

7th April 1924.—Under Rule 81 of the Fundamental Rules, M.R.Ry. A. V. Sundaram Ayyar, Extra Assistant Conservator of Forests, South Vellore, is granted leave on average pay for six weeks from 23rd April 1924.

2. He will be permitted to prefix the Easter holidays provided the conditions laid down in the subsidiary rules under Fundamental Rule 68 are fulfilled

Under Subsidiary Rule (2) under Fundamental Rule 104, Mr. H E. Brown, Probationary Extra Assistant Conservator of Forests, is granted extension of leave for one month in continuation of the leave already granted to him, subject to the certificates of eligibility from the Accountant-General.

10th April 1924.—No. 114.—Mr F. D. Ardagh, District Forest Officer, the Nilgiris, is granted leave on average pay for one month with effect from the date of relief.

12th April 1924.—Mr. A. M. C. Littlewood, District Forest Officer, Guntur, is granted leave on average pay for six weeks from 29th April 1924.

Mr C J. Van Haeften, Extra Assistant Conservator of Forests, Guntur, is posted to be in charge of the Division during the period of absence of Mr. A. M. C. Littlewood, on leave.

28th April 1924.—In modification of this office L. Dis No. 115/24, dated 29th January 1924, M.R.Ry P Govinda Menon Extra Assistant Conservator of Forests, is granted privilege leave for 11 days from 12th December 1923 with permission to affix the Christmas holidays to the leave provided the conditions laid down in the subsidiary rules under Fundamental Rule 68 were satisfied.

1st May 1924.—M.R.Ry. B. A. Cariappa, Probationary Exra Assistant Conservator of Forests, is posted to the Forest Exploitation Division, Olavakode. He should report himself to the Logging Engineer for duty.

Mr. H. E Brown, Probationary Extra Assistant Conservator of Forests, on the expiry of his leave, is posted to the Nilgiris for the verification of forest boundaries.

9.—Bombay Gazette.

16th April 1924.—No. S. 20/10/6610.—The Governor with the concurrence of the Minister is pleased to appoint Messrs. C. G. Abichandani and Abdul Rahim as Probationary Extra Assistant Conservators of Forests.

28th April 1924.- No. 110-A.D.—The Governor with the concurrence of the Minister is pleased to create, with effect from 1st January 1924, a temporary appointment of Superintending Engineer on pay of Rs. 1 750—100—2,150 in the Forest Department for a period of five years and appoint Mr. T. S. Pipe to hold it.

No. P. 191.—In supersession of Government Notifications* the Governor with the concurrence of the Minister is pleased to make the following appointments :—

(1) Mr Jagan Nath Dutt to be Extra Assistant Conservator of Forests from 23rd December 1921, *vice* Mr K. R. Hattiangadi, dismissed from the service

(2) Mr. S. P. Pandya to be Extra Assistant Conservator of Forests from 5th January 1922, *vice* Mr M. D. Jagtiani, retired.

(3) Mr. T. K. Mirchandani to be Extra Assistant Conservator of Forests from 31st May 1922, *vice* Mr. H. A. Bhadbhade, retired.

(4) Mr. S. N. Kesarcodi to be Extra Assistant Conservator of Forests from 13th September 1922, *vice* Mr. V. G Bhalerao, retired.

2nd May 1924.—No. 418.—Mr R A Hemmadi, Deputy Conservator of Forests, on Exploitation Duty, Kanara, is granted leave on average pay for six weeks, with effect from 11th April 1924 or the subsequent date of relief.

5th May 1924.—No. S 20/10/7278.—Mr. T. N. Koppikar, Divisional Forest Officer, West Thana, is granted, with effect from 2nd April 1924, leave on average pay on medical certificate for three months with permission to prefix the Easter holidays

The Governor with the concurrence of the Minister is pleased to appoint Mr E. A Garland, Assistant to the Divisional Forest Officer West Nasik, to act as Divisional Forest Officer, West Thana, *vice* Mr T. N Koppikar proceeded on leave

7th May 1924.—No. S /10.—The Governor with the concurrence of the Minister is pleased to make the following appointments :—

Mr. C. E L. Gilbert, Divisional Forest Officer, Belgaum, to act as Conservator of Forests, Sind Circle, *vice* Mr. P. E. Aitchison proceeding on leave, pending further orders.

Mr. R A Hemmadi on return from leave, to be Divisional Forest Officer, Belgaum, *vice* Mr C. E. L. Gilbert.

10.—Burma Gazette.

5th April 1924.—No. 88.—Maung Hla Min, Extra Assistant Conservator of Forests, on probation, attached to the South Pegu Forest Division, is transferred from Pegu and posted to the Tharrawaddy Forest Division as Revenue Assistant, in place of Maung Ni, Extra Assistant Conservator of Forests, deceased

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* No. S. 20/10/4334, dated 8th April 1922.
No. A-375, dated 23rd August 1922.
No. A-499, dated 20th September 1922.
No. S. 20/10/14458(*a*), dated 6th October 1922.

No. 89.—Under the provisions of Rules 80 and 81 of the Fundamental Rules, leave on average pay for eight months and in continuation thereof leave on half average pay for two months, for a total period of ten months is granted to Mr. G C Cheyne, Deputy Conservator of Forests, in charge of the Myitmaka Extraction Division, with effect from the 24th April 1924 or the subsequent date on which he avails himself of it.

No. 90.—Mr T Marlow, Forest Engineer, attached to the Myitmaka Extraction Division, is placed in charge of that Division, in place of Mr. G. C Cheyne, Deputy Conservator of Forests, proceeding on leave.

8th April 1924.—No. 91.—Mr G A Brown, Extra Assistant Conservator of Forests, on probation attached to the Pyinmana Forest Division, is transferred from Pyinmana and is posted to duty in the South Tenasserim Forest Division with headquarters at Mergui, in place of Maung Han, Extra Assistant Conservator of Forests, proceeding on leave.

No. 92.—Under the provisions of Rules 80 and 81 of the Fundamental Rules, leave on average pay for four months and in continuation thereof leave on half average pay for two months, for a total period of six months is granted to Maung Hmon, Extra Assistant Conservator of Forests, attached to the South Tenasserim Forest Division, with effect from the date on which he is relieved of his duties by Mr. G A. Brown, Extra Assistant Conservator of Forests, on probation.

No. 94.—Under the provisions of Rules 80 and 81 of the Fundamental Rules, leave on average pay for six months is granted to Mr. J A V Welsh, Forest Engineer, attached to the Sutang Circle, with effect from the 22nd April 1924. Mr Welsh is permitted to prefix to his leave the Easter holidays from the 18th to the 21st April 1924, both days inclusive.

No. 95.—Under the provisions of Rules 80 and 81 of the Fundamental Rules, leave on average pay for eight months is granted to Mr E. W Carroll, Deputy Conservator of Forests in charge of the Thaton Forest Division, with effect from the 6th May 1924 or the subsequent date on which he avails himself of it.

No. 96.—Mr B P Kelly, Deputy Conservator of Forests, attached to the South Tenasserim Forest Division, is transferred from Tavoy and posted to the charge of the Thaton Forest Division in place of Mr. E W Carroll, Deputy Conservator of Forests, proceeding on leave.

16th April 1924.—No. 100.—Having satisfactorily completed the course of training at the Forest Research Institute and College, Dehra Dun, to which they were deputed by this Government, Maung Tun Ngwe and Mr. C J Ferdinands are appointed to be Extra Assistant Conservators of Forests, on probation, on Rs. 300 per mensem, with effect from the 29th March 1924, and are posted to the Mogok and Zigon Forest Divisions, respectively.

No. 101.—Under the provisions of Rules 80 and 81 of the Fundamental Rules, leave on average pay for three months is granted to Maung Win Maw, Extra Assistant Conservator of Forests, attached to the Mogok Forest Division, with effect from the date on which he avails himself of it.

No. 103.—Under the provisions of Rules 80 and 81 of the Fundamental Rules, leave on average pay for eight months and in continuation thereof, leave on half average pay for one year and eight months, for a total period of two years and four months is granted to Mr. J D. Clifford, Divisional Forest Officer, Southern Shan States Division, and Principal Forest Officer, Federated Shan States, with effect from the 1st May 1924 or the subsequent date on which he avails himself of it.

No. 104.—On return from leave Mr D Xavier, Extra Assistant Conservator of Forests, on probation, is reposted to duty in the Upper Chindwin Forest Division.

No. 105.—Under the provisions of Rules 80 and 81 of the Fundamental Rules, leave on average pay for four months is granted to Mr. G. Aubert Extra Assistant Conservator of Forests, on probation, attached to the Mu Forest Division, with effect from the 3rd April 1924 or the subsequent date on which he avails himself of it.

26th April 1924.—No. 106.—On return from leave, Mr. H. R. Blanford, Deputy Conservator of Forests, who has been appointed to officiate as a Conservator of Forests, is placed in charge of the Northern Circle, in place of Mr. C F Bell, Officiating Conservator of Forests, who remains in charge of the Central Circle.

No 107.—Mr C F Bell, Officiating Conservator of Forests made over and Mr. H R. Blanford, Officiating Conservator of Forests, received charge of the Northern Circle on the 3rd April 1924, afternoon.

No 108.—Mr. C R. Robbins, Assistant Conservator of Forests, attached to the office of the Conservator of Forests Working Plans Circle is appointed Silviculturist, Burma, in place of Mr A. H. M. Barrington, Deputy Conservator of Forests and Silviculturist, transferred

No 109.—Pending the assumption of charge of the duties of the Silviculturist by Mr. C R. Robbins, Mr H R Blanford Officiating Conservator of Forests, Northern Circle, is appointed Silviculturist, Burma, as a temporary measure, in addition to his own duties.

No. 110.—Mr A H M. Barrington, Deputy Conservator of Forests and Silviculturist, Burma, who has been appointed to officiate as a Conservator of Forests is transferred from Maymyo and posted to the charge of the Delta Forest Circle, in place of Mr. H C. Walker, Conservator of Forests, transferred

No. 111.—Mr H C. Walker, Conservator of Forests Delta Circle, is transferred from Rangoon and posted to the charge of the Northern Forest Circle, in place of Mr. H R. Blanford Officiating Conservator of Forests, transferred.

No 112.—Mr. H. R. Blanford, Officiating Conservator of Forests, Northern Circle, is posted to the charge of the Working Plans Circle in place of Mr. H. W. A Watson, Conservator of Forests, proceeding on leave

28th April 1924.—No. 113.—Mr J C. Hopwood, Conservator of Forests, was permitted to resign the Indian Forest Service, with effect from the 17th March 1924.

No 114.—Mr J C Hopwood, Conservator of Forests was granted by His Majesty's Secretary of State for India an extension of leave on half average pay for five days in continuation of the leave granted to him in Revenue (Forest) Department Notification No 142, dated the 16th August 1922

3th April 1924.—No. 116.—Pending the arrival of Mr R. A. Cochrane, Deputy Conservator of Forests, who was posted to the charge of the Prome Forest Division in this Department Notification No. 80, dated the 26th March 1924 Mr. D T Griffiths, Assistant Conservator of Forests attached to the Prome Division, is placed in charge of that Division as a temporary measure.

LIST OF BOOKS AND PUBLICATIONS RECEIVED BY THE HONORARY EDITOR DURING THE MONTHS OF APRIL-MAY 1924.

The Tropical Agriculturist, Vol LXII, No 3, March 1924.

The Scottish Geographical Magazine, Vol. XL, No. 2, dated 5th March 1924.

Studies in Indian Oil Seeds, No. 2, Linseed—Memoirs of the Department of Agriculture in India, Botanical Series, Vol XII, No 4 January 1924

Studies in Gujarat Cottons. Part II—Memoirs of the Department of Agriculture in India, Botanical Series. Vol XII, No 5. March 1924

Administration Report of the Forest Department of the Madras Presidency for the year ending 31st March 1923

The Review of Applied Entomology, Series A: Agricultural and Series B: Medical and Veterinary, Vol. XII. Part 3, March 1924.

The Timber Trades Journal, Vol XCV, Nos. 2483, 2484 and 2485, dated 29th March and 5th and 12th April 1924.

Indian Engineering, Vol LXXV, Nos. 16, 17, 18 and 19 dated 19th, and 26th, April and 3rd and 10th May 1924

Commercial News, Vol. II (New Series), No. 1, dated 31st March 1924.

The Hardwoods of Western Australia By S L Kessell, Conservator of Forests, 1923.

Clear Cutting or Shelterwood, by Sir William Schlich. Reprinted from the Quarterly Journal of Forestry, April 1924.

Journal of Forestry, Vol. XXII, No. 2, February 1924.

Some Results of Cutting in the Sierra Forests of California—U. S. Department of Agriculture. Department Bulletin No 1176, dated 24th November 1923

The Larch Longicorn Beetle—Forestry Commission, Leaflet No. 13.

Transactions of the Royal Scottish Arboricultural Society, Vol. XXXVIII, Part I, March 1924.

Quarterly Journal of Forestry, Vol. XVIII, No 2, April 1924.

C. Leary and Company's London Market Reports, 1st to 31st March 1924.

The Australian Forestry Journal, Vol VII, No. 3, March 1924.

Proceedings of the Legislative Council of the Governor of Madras, Vol. XVII, No. 1, dated 4th March 1924

Industrial India, Vol. 3, No. 9, April 1924.

Allahabad:—Printed and published at the Pioneer Press, by C. G. HARRIS
No. 726—1-6-24.

GAZETTE NOTIFICATION.

1.—Gazette of India.

12th May 1924.—No. 172.—Mr. A. H. M. Barrington, Deputy Conservator of Forests, Burma, is appointed to officiate as Conservator of Forests in Burma, with effect from the forenoon of the 10th April 1924.

20th May 1924.—No. 191.—In the Notification of this Department No. 455, dated the 6th March 1924 *for* "15. Mr. Shukumar Sen Chaudhri". *substitute* "15, Mr. Shukumar Chaudhri".

This Department's Notification No. 127, dated the 30th April 1924, is cancelled.

22nd May 1924.—No. 199.—In this Department Notification No. 125, dated the 30th April 1924, relating to the appointment of Dr. Jatindra Nath Sen to officiate as Forest Chemist at the Forest Research Institute, Dehra Dun, for the words "from the forenoon of the 15th April 1924" *read* "from the forenoon of the 14th April 1924".

28th May 1924.—No. 219.—On return from leave Mr. M. C. C. Bonington, Deputy Conservator of Forests, assumed charge as Divisional Forest Officer, South Andaman Forest Division, with effect from the 19th April 1924.

The unexpired balance of his leave is hereby cancelled.

2.—Bengal Gazette.

17th May 1924.—No. 26 For.—Mr. S. Chaudhuri, Assistant Conservator of Forests, attached to the Kurseong Division, is posted to the charge of the Bagdogra Range of that Division with headquarters at Bagdogra, with effect from the 1st June 1924.

3.—Bihar and Orissa Gazette.

4th May 1924.—No. 35—IIIF-123-R.T.—Maulavi Saiyid Manzur Ahsan, Probationary Extra Assistant Conservator of Forests, is appointed to be Extra Assistant Conservator of Forests (Supernumerary), with effect from the 1st April 1924.

No. 36—IIIF-123-R.T.—Mr. P. W. Augier, Probationary Extra Assistant Conservator of Forests, is appointed to be Extra Assistant Conservator of Forests, with effect from the 1st April 1924.

21st May 1924.—No. 5229—IIIF-125-R.—The Services of Mr. F. C. Osmaston, Assistant Conservator of Forests, Bihar and Orissa, were placed at the disposal of the Government of India, Department of Education, Health and Lands, with effect from the 18th April 1924.

4.—Assam Gazette.

1st May 1924.—No. 996R.—Babu Anil Kumar Adhikari, Extra Assistant Conservator of Forests, is granted combined leave for four months, *viz.*, leave on average pay for three months and twenty-six days and leave on half average pay for the remaining period, under rule 81 of the Fundamental Rules, with effect from the 1st May 1924, or any subsequent date on which he may avail himself of it.

No. 998R.—Mr. Rajendra Nath De, Extra Assistant Conservator of Forests, whose services have been replaced at the disposal of the Government of Assam, is attached of the Kamrup Forest Division.

No. 1006R.—The following officers are appointed Probationary Extra Assistant Conservators of Forests, on a pay of Rs. 250 each per mensem, with effect from the 22nd March 1924 and are attached to the Forest Divisions noted below:—

1. Babu Ramesh Chandra Datta ... ... Cachar Division.
2. Babu Kamana Krishna Biswas ... ... Goalpara Division.
3. Babu Rajani Mohan Das ... ... Sibsagar Division.

5*th May* 1924.—No. 1035R.—Babu Narendra Nath Das, Extra Assistant Conservator of Forests, is granted leave on average pay for two months and twenty days, under rule 81 of the Fundamental Rules, with effect from the 11th May 1924, or any subsequent date on which he may avail himself of it.

16*th May* 1924.—No. 1159R.—Mr. H. P. Smith, Deputy Conservator of Forests, is appointed to hold charge of the Goalpara Forest Division, with effect from the afternoon of the 4th April 1924.

19*th May* 1924.—No. 1165R.—Babu Dwijendra Nath De, Extra Assistant Conservator of Forests, is appointed temporarily to hold charge of the Darrang Forest Division, with effect from the afternoon of the 7th May 1924, *vice* Captain G. A. Nevil on leave.

21*st May* 1924.—No 1189 R.—Mr. Rajendra Nath De, Extra Assistant Conservator of Forests, is granted combined leave for seven months out of India and Ceylon, *viz.*, privilege leave for five months and twenty-eight days and leave on average pay for one month and two days, under rule 81(*b*) of the Fundamental Rules and the note thereunder, with effect from the 12th May 1924, or any subsequent date on which he may avail himself of it.

5.—United Provinces Gazette.

5*th May*, 1924.—No. 13.—Pandit Tula Ram, Extra Assistant Conservator of Forests, attached to the Dehra Dun Forest Division in the Western Circle, is posted to the charge of that Division.

8*th May* 1924.—No. 14.—Mr. J. Stephens, Assistant Conservator of Forests, attached to the North Kheri Forest Division in the Eastern Circle, is transferred to the charge of the South Kheri Forest Division in the same Circle, *vice* Mr. G. O. Coombs, Deputy Conservator of Forests, granted leave.

31*st May* 1924.—No. 15.—Mr. H. G. Champion, Deputy Conservator of Forests, in charge of the Haldwani Forest Division in the Western Circle, is granted leave on average pay from the 15th June to 31st August 1924, both days inclusive.

6.—Punjab Gazette.

7*th May* 1924.—Lala Prithi Nath, Probationary Extra Assistant Conservator of Forests, is posted to Northern Plantation Division (Western Circle) as an attached officer, with headquarters at Changa-Manga, with effect from 30th March 1924 (forenoon), after passing the Provincial Service Course of the Imperial Forest College, Dehra Dun.

Lala Khem Chand, Probationary Extra Assistant Conservator of Forests, is posted to Lahore Forest Division (Western Circle) as an attached officer, with headquarters at Lahore, with effect from 30th March 1924 (forenoon), after passing the Provincial Service Course of the Imperial Forest College, Dehra Dun.

No. 10.—Lala Ishwar Dass, Extra Assistant Conservator of Forests, attached to the Kangra Forest Division (Eastern Circle), is granted 8 months' leave, *viz.*, 4 months' leave on average pay (including privilege leave for 1 month and 20 days) combined with 4 months' leave on half average pay, under rule 81 of the Fundamental Rules, with effect from 25th April 1924 (afternoon).

8*th May* 1924.—No. 11.—Bhai Dalip Singh, Extra Assistant Conservator of Forests in charge, Depôt West Division (Utilisation Circle), is transferred to the Depôt West

Division (Utilization Circle) as an attached officer with headquarters at Doraha, with effect from 3rd May 1924 (forenoon), on relief by Khan Mohammad Khan, Extra Assistant Conservator of Forests, of the charge of Depôt West Division, on the 28th April 1924 (afternoon), from which date up to 2nd May 1924, he remained in transit.

22nd May 1924.—No. 14557.—Mr. L B. Holland, Deputy Conservator of Forests, Lahore Forest Division (Western Circle) is granted 6 months and 5 days leave on average pay under rule 81 of the Fundamental Rules, with effect from 15th April 1924 (afternoon), on relief by Mr. W. E. Flewett, Deputy Conservator of Forests, attached to the Lahore Forest Division.

No. 14558.—Mr. W. E. Flewett, Deputy Conservator of Forests, attached to the Lahore Forest Division, is posted to the charge of the Lahore Forest Division, with headquarters at Lahore, with effect from 15th April 1924 (afternoon).

No. 14635.—Sardar Sohan Singh, Probationary Extra Assistant Conservator of Forests, is promoted to be an Extra Assistant Conservator of Forests, with effect from 31st March 1924.

Mian Udey Singh, Extra Assistant Conservator of Forests, on probation, is promoted to be an Extra Assistant Conservator of Forests, with effect from 1st April 1924.

7.—Central Provinces Gazette.

21st May 1924.—No. 2018-1042-III.—Mr. Muhammad Ismail, Extra Assistant Conservator of Forests, attached to the Balaghat Forest Division, is appointed to officiate as Divisional Forest Officer, and is posted in charge of the Akola Forest Division.

No. 2019-1042-III.—On relief by Mr. Muhammad Ismail, Mr. P. R. Katpitia, Extra Assistant Conservator of Forests, in charge of the Akola Forest Division, is transferred in the same capacity to the charge of the Amraoti Forest Division.

No. 2020-1042-III.—On relief by Mr. Katpitia, Rai Sahib Laiq Singh, Extra Assistant Conservator of Forests, in charge of the Amraoti Forest Division, is transferred in the same capacity to the charge of the Seoni Forest Division.

Orders Nos. 1816-408-III and 1817-408-III, dated the 5th May 1924, are hereby cancelled.

29th May 1924.—No. 2099-1081-III.—Under rule 81 (*b*) of the Fundamental Rules, leave on average pay for six months is granted to Mr. H. C. Watts, Deputy Conservator of Forests, attached to the South Raipur Division, with effect from the 12th May 1924.

8.—Madras Gazette.

13th May 1924.—Under rule 81 of the Fundamental Rules, M. Amir Badsha Sahib Bahadur, Extra Assistant Conservator of Forests, attached to the South Mangalore Division, is granted leave on average pay for three months, with effect from the date of relief (subject to the certificate of eligibility by the Accountant-General).

No. 149.—M. R. Ry. E. K. Krishnan Avargal, Extra Assistant Conservator of Forests, is granted an extension of leave on average pay on medical certificate for eight days from 6th April 1924 and leave on half average pay for one month and twenty-two days in continuation thereof.

17th May 1924.—No. 153.—Major W. F. Chipp, lately of the Punjab Forest Department, is appointed temporary Forest Engineer in this Presidency, with effect from the forenoon of 26th April 1924.

19th May 1924.—Under rule 81 of the Fundamental Rules, Mr. J. C Wrench, Assistant Conservator of Forests, Bellary, is granted leave on average pay for five weeks and four days, with effect from 23rd April 1924, with permission to prefix the Easter holidays from 17th April 1924 provided the conditions of the subsidiary rulings under rule 68 of the Fundamental Rules are fulfilled.

26th May 1924.—M.R.Ry. B. S. Kesava Vittal, Extra Assisstant Conservator of Forests, is on the expiry of his leave, posted to the Wynad Division to work under the District Forest Officer.

No. 167.—The following appointments are ordered in the Forest Department :—

Captain H. A. Irwin, M. C., Forest Exploitation Officer is appointed to hold full charge of the duties of the Forest Engineer in addition to his own from the afternoon of 1st April 1924 until the date of Major Chipp's assumption of charge as Forest Engineer.

27th May 1924.—No. 166.—Mr. F. D. Ardagh, Deputy Conservator of Forests, is granted an extension of leave on average pay for three days in continuation of the leave for one month already granted to him.

29th May 1924.—No. 168.—Mr. D. McD. Currie, on special duty to act as District Forest Officer, the Nilgiris, *vice* Mr. F. D. Ardagh granted leave or until further orders. (To take effect from the date of joining.)

No. 169.—(i) Mr. W. G. Dyson, M.C , Principal, Madras Forest College, to be District Forest Officer, the Nilgiris, from or after 20th July 1924 in relief of Mr. Currie.

(ii) Mr. C. R. F. Williams, M.C., Senior Instructor, Madras Forest College, to be Principal of that College, *vice* No. (i) above.

(iii) Mr. J. A. Wilson, Assistant Conservator, to be Senior Instructor, Madras Forest College, *vice* No. (ii) above.

No. 170.—The following posting of a Forest Officer is ordered :—

Mr. T. A. Whitehead, Acting Conservator of Forests, Third Circle, to undertake the reclassification of the reserved forests in the Presidency in addition to his own duties.

2nd June 1924.—Mr. A. M. C. Littlewood, District Forest Officer, Gunter, will be considered to have been on leave on average pay during the period from the 13th April 1924 to 23rd April 1924 (both days inclusive).

Under rule 81 of the Fundamental Rules, M.R.Ry. A. V. Sundaram, Extra Assistant Conservator of Forests, is granted extension of leave on average pay for seventeen days with effect from 4th June 1924.

5th June 1924.—No. 177.—Mr. T. A. Whitehead, Acting Conservator of Forests, Third Circle, to be in full additional charge of the Second Circle during Mr. T. Clear's absence on leave or until further orders.

No. 174.—Under rule 83 of the Fundamental Rules, Mr. O. H. C. Shelswell, Deputy Conservator of Forests, is granted special disability leave for 12 months, with effect from the date of relief.

6th June 1924.—No. 175.—Mr. T. Clear, Acting Conservator of Forests, II Circle, is granted leave on average pay for fifteen days, with effect from the 9th June 1924.

No. 176.—Mr. F. D Ardagh, Deputy Conservator of Forests, is granted leave on average pay for eight months, with effect from the date of relief.

No. 178.—The following postings are ordered in the Forest Department :—

(1) M.R.Ry. E. K. Krishnan Avargal, Extra Assistant Conservator of Forests, to be District Forest Officer, North Vellore, on return from leave.

(2) Muhammad Abdul Hafiz Sahib Bahadur, Extra Assistant Conservator of Forests, to be District Forest Officer, East Kurnool, on return from leave.

9.—Bombay Gazette.

9th May 1924.—No. S. 20/10/7647.—Mr. D. B. Sothers, Divisional Forest Officer, Kanara Eastern Division, is granted, with effect from 1st November 1924 or the subsequent date on which he may be relieved, leave on average pay for eight months and on half average pay for four months.

19th May 1924.—No. S. 20/10/7245-D.—In supersession of Government Notification No. S. 20/10/17064, dated 21st November 1923, Mr. H. W. Starte, Deputy Conservator of Forests, is granted, with effect from 16th December 1923, leave on average pay for five months and half average pay for five months and a half.

10.—Burma Gazette.

2nd May 1924.—No. 117.—The services of Mr. H. S. Single, Deputy Conservator of Forests, Burma, are placed at the disposal of the University College, Rangoon, for employment as Lecturer in Forestry, with effect from the 1st May 1924.

3rd May 1924.—No. 118.—Mr. H. C. Walker, Conservator of Forests, made over, and Mr. A. H. M. Barrington, officiating Conservator of Forests, received charge of the Delta Circle on the 10th April 1924, before noon.

No. 119.—Mr. H. R. Blanford, Officiating Conservator of Forests, made over, and Mr. H. C. Walker, Conservator of Forests, received, charge of the Northern Circle on the 19th April 1924, before noon.

No. 120.—Mr. H. W. A. Watson, Conservator of Forests, made over, and Mr. H. R Blanford, officiating Conservator of Forests, received, charge of the Working Plans Circle on the 19th April 1924, afternoon.

5th May 1924.—No. 121.—Under the provisions of rules 80 and 81 of the Fundamental Rules, leave on average pay for six months is granted to Mr. J. D. Hamilton, Deputy Conservator of Forests, incharge of the Depôt and Agency Forest Division, Rangoon, with effect from the 24th April 1924.

The leave is granted on medical certificate.

No. 122.—Mr. D. W. Hughes, Assistant Conservator of Forests, attached to the Mandalay Depôt Forest Division, is transferred from Mandalay and posted to the charge of the Depôt and Agency Forest Division, Rangoon.

No. 123.—Pending the arrival of Mr. D. W. Hughes, Assistant Conservator of Forests, Mr F. W T. Bodeker, Extra Assistant Conservator of Forests, attached to the Depôt and Agency Forest Division, Rangoon, is placed in charge of that Division, as a temporary measure in addition to his own duties.

No 124.—Mr. J. W. R. Sutherland, Assistant Conservator of Forests, attached to the Pyinmana Forest Division, is transferred from Pyinmana and posted to duty in the Mandalay Depôt Forest Division, in place of Mr. D. W. Hughes, Assistant Conservator of Forests. transferred.

No. 125.—Mr. G. P. Walden. Extra Assistant Conservator of Forests and Instructor (Minor), Burma Forest School, Pyinmana, is appointed to be Instructor (Major), in place of Mr C. W. Scott, Deputy Conservator of Forests, appointed as Director of the School.

No. 126.—Mr. D. Edge, Extra Assistant Conservator of Forests, attached to the Insein Forest Division, is transferred from Insein and is appointed to be Instructor (Minor), Burma Forest School, Pyinmana, in place of Mr. G. P. Walden, Extra Assistant Conservator of Forests, appointed as Instructor (Major) of the School.

No. 127.—Mr. L. F. Edgerley, Extra Assistant Conservator of Forests, on probation, attached to the Tharrawaddy Forest Division, is transferred from Tharrawaddy and is posted to duty in the Insein Forest Division, in place of Mr. D. Edge, Extra Assistant Conservator of Forests, transferred.

No. 128.—Prior to his proceeding on leave granted in this Department Notification No. 83, dated the 28th March 1924, Mr. F. C. Purkis, Deputy Conservator of Forests, was placed on special duty in the office of the Conservator of Forests, Delta Circle.

7ht May 1924.—No. 129.—Under the provisions of rules 80 and 81 of the Fundamental Rules, Mr. G. T. Wrafter, Deputy Conservator of Forests, whose services have been replaced at the disposal of this Government, is granted leave on average pay for eight months and in continuation thereof leave on half average pay for four months, for a total period of one year, with effect from the date on which he is relieved of his duties in the Bhopal State.

Mr. Wrafter proceeds to England.

No. 130.—Mr. D. J. Monro, Extra Assistant Conservator of Forests, attached to the Henzada-Ma-ubin Forest Division, is placed in charge of that Division, in place of Mr. H.S. Single, Deputy Conservator of Forests, whose services have been placed at the disposal of the University College, Rangoon.

No. 131.—Mr. H. Hilbert, Extra Assistant Conservator of Forests on duty in the Salween Forest Division, is transferred from Moulmein and posted to duty in the North Pegu Forest Division.

No. 132.—Under the provisions of rules 80 and 81 of of the Fundamental Rules, leave on average pay for three months and twelve days (on medical certificate) is granted to Mr D. Edge, Extra Assistant Conservator of Forests, attached to the Insein Forest Division, with effect from the forenoon of the 13th December 1923.

No. 133.—On return from leave, Mr. D. Edge, Extra Assistant Conservator of Forests, is reposted to duty in the Insein Forest Division.

14th May 1924.—No. 137.—Mr. H. L. Kirby, Assistant Conservator of Forests, attached to the Insein Forest Division, is transferred from Insein and is posted to duty in the North Toungoo Forest Division, with headquarters at Toungoo.

No. 138.—Mr. A. Hyde-Johnson, Assistant Conservator of Forests, attached to the North Toungoo Forest Division, is transferred from Toungoo and is posted to duty in the Insein Forest Division, with headquarters at Insein.

No. 139.—Mr. G. W. M. Woods, Assistant Conservator of Forests, attached to the Maymyo Forest Division, is transferred from Maymyo and is posted to duty in the Prome Forest Division, with headquarters at Prome.

No. 140.—Mr. P. N. H. Garnett, Assistant Conservator of Forests, attached to the Prome Forest Division, is transferred from Prome and is posted to duty in the Maymyo Forest Division, with headquarters at Maymyo.

19th May 1924.—No. 141.—Under the provisions of rules 80 and 81 of the Fundamental Rules, leave on average pay for one month is granted to Mr. F. G. Caldecourt, Extra Assistant Conservator of Forests and Revenue Assistant, Zigôn Forest Division, with effect from the date on which he avails himself of it.

No. 142.—Mr. R. S. Troup, C.I.E., Conservator of Forests, was permitted to resign the Indian Forest Service, with effect from the 13th April 1924.

22nd May 1924.—No. 143.—Under the provisions of rules 80 and 81 of the Fundamental Rules, leave on average pay for one month and ten days is granted to Mr. J. M. Campbell, Extra Assistant Conservator of Forests and Revenue Assistant in the North Pegu Forest Division, with effect from the 21st March 1924. On return from leave Mr. J. M. Campbell, Extra Assistant Conservator of Forests, is reposted to the North Pegu Forest Divisfon as Revenue Assistanr.

No. 144.—This Department Notification No. 116, dated the 30th April 1924, placing Mr. D.T. Griffiths, Assistant Conservator of Forests, in charge of the Prome Division measure, as a temporay is hereby caneelled.

LIST OF BOOKS AND PUBLICATIONS RECEIVED BY THE HONORARY EDITOR DURING THE MONTHS OF MAY-JUNE 1924.

A List of Oriental Vernacular Names of the Genus *Dioscorea*—The Garden's Bulletin Straits Settlements, Vol. III, Nos. 4—6, 15th April 1924.

Experiment Station Record, Vol. 50, No. 1, January 1924.

Proceedings of the Legislative Council of the Governor of Madras, Vol. XVII, No. 2 dated 6th March, No 7 dated 19th March, No. 8, dated 20th March, No. 9 dated 21st March, No. 10 dated 22nd March and No. 11, dated 24th March 1924.

The Timber Trades Journal, Vol. XCV, No. 2486 dated 19th April, No. 2487 dated 26th April and No. 2488, dated 3rd May 1924.

The Indian Engineering Nos. 20, 21, and 22 dated 17th, 24th and 31st May 1924

The Tropical Agriculturist, Vol. XLII, No. 4, April 1924.

The Review of Applied Entomology, Series A: Agricultural, and Series B: Medical and Veterinary, Vol. XII, Part 4, 1924.

Revue des Eate et Forests, Vol. LXII, No. 4, April 1924.

The Fundamentals of Intensive Lac Production (By M. Srinivasayya, Bangalore).

Year Book of the Department of Agriculture, Ceylon, 1924.

The Agricultural Journal of India, Vol. XIX, Part III, May 1924.

Botanical Notes—Kimberely Division of Western Australia, Forests Department, Bulletin No. 32, 1923.

C. Leary and Co.'s London Market Reports, 1st to 30th April 1924.

Irrigation Practice in growing small fruits in California—University of California, Agricultural Experiment Station, Circular No. 154, Revised May 1923.

Small Fruit Culture in California—University of California, Agricultural Experiment Station, Circular No. 164, Revised May 1923.

Unfermented Fruit Juices—University of California, Agricultural Experiment Station, Circular No. 220, Revised July 1923.

Cabbage Production in California—University of California, Agricultural Experiment Station, Circular No. 262, May 1923.

Tomato Production in California—University of California, Agricultural Experiment Station, Circular No. 263, May 1923.

Preliminary Essentials to Bovine Tuberculosis Control in California—University of California, Agricultural Experiment Station, Circular No. 264, May 1923.

Plant Disease and Pest Control—University of California, Agricultural Experiment Station, Circular No. 265, June 1923.

Turkish Tobacco Culture, Culling and Marketting—University of California, Agricultural Experiment Station, Bulletin No. 366, June 1923.

Comparison of Woods for Butter Boxes—University of California, Agricultura Experiment Station, Bulletin No. 369, August 1923.

Allahabad :—Printed and published at the Pioneer Press, by C. G. HARRIS,
No. 827—1-7-24.

GAZETTE NOTIFICATIONS.

1.—Gazette of India.

31st July 1924.—No. 423.—Mr R. B. Cornwell, Deputy Conservator of Forests and Divisional Forest Officer, North Andaman Division, has been granted leave on average pay for four months with effect from the afternoon of the 18th June 1924.

2.—Bengal Gazette.

30th June 1924.—No. 28 *For.*—Babu Bhola Nath Bhattacharji, Extra Assistant Conservator of Forests, is allowed leave on average pay for three months, under articles 81 (*b*) (*ii*) of the Fundamental Rules, with effect from the 2nd July 1924. He is permitted to affix the Durga Puja holidays to the leave.

No. 29-*For*—Babu Jitendra Nath Sen Gupta, Probationary Extra Assistant Conservator of Forests, is allowed leave on average pay on medical certificate) for 15 days, under article 81 *b*) (*ii*) of the Fundamental Rules, with effect from the 7th June 1924 or any subsequent date from which he may avail himself of the same.

3.—Bihar and Orissa Gazette.

24th July 1924.—No. 12-*Forests.*—On being relieved of the charge of the Porahat Forest division, Mr. W. D. M. Warren, Assistant Conservator of Forests, is retransferred to the Saranda Forest Division.

1st August 1924.—No. 7818-III *F-227-R.*—Mr. L. R. Sabharwal, Assistant Conservator of Forests is granted leave on average pay for eight months, under Fundamental Rules 77 and 81, with effect from the 4th August 1924 or any subsequent date on which he may avail himself of it.

4th August 1924.—No. 13-*Forests.*—Mr. W. D. M. Warren, Assistant Conservator of Forests, attached to the Saranda Forest Division, is transferred temporarily to the charge of the Angul Forest Division during the absence on leave of Mr. L. R. Sabharwal.

4.—Assam Gazette.

Nil.

5.—United Provinces Gazette.

4th July 1924.—No. 23.—Thakur Bashi Ram, Extra Assistant Conservator of Forests, attached to the Ramnagar Forest Division in the Western Circle, is granted leave on average pay for one month, with effect from the 7th July 1924, or subsequent date.

9th July 1924.—No. 24.—Pandit Dharni Dhar Joshi, Extra Assistant Conservator of Forests, attached to the Dehra Dun Forest Division in the Western Circle, is granted leave on average pay for 26 days followed by leave on half average pay for one month and four days or a total period of two months from the 15th July 1924, or subsequent date.

12th July 1924.—No. 25.—Pandit Bhawani Dat Pant, Extra Assistant Conservator of Forests, on return from 22 days' leave on average pay granted to him in this Office Notification No. 16, dated the 10th June, 1924, is re-posted to the Lansdowne Forest Division in the Western Circle as an attached officer.

18th July 1924.—No. 26.—Mr. M. D. Chaturvedi, Assistant Conservator of Forests, attached to the Gorakhpur Forest Division in the Eastern Circle, is transferred to the Direction Division, Working Plan and Research Circle, as an attached officer.

24th July 1924.—No. 27.—Mr. R. N. Singh, Assistant Conservator of Forests, attached to the Bahraich Forest Division in the Eastern Circle, is transferred to the charge of the Gonda Forest Division in the same Circle.

30th July 1924.—No. 28.—Mr. W. F. Coombs, Extra Assistant Conservator of Forests, attached to the Gorakhpur Division in the Eastern Circle, to hold charge of that Division as a temporary measure

6.—Punjab Gazette.

21st July 1924.—No. 17938.—The services of Major W. F. Chipp, D.S.O., M.C., Forest Assistant attached to the office of the Chief Conservator of Forests, Punjab, has been terminated from 29nd April 1924 (afternoon), on his being appointed as temporory Forest Engineer in the Madras Presidency.

7.—Central Provinces Gazette.

7th August 1924.—No. 3015-1577-III.—On return from leave, Mr. W. A. Muir, Deputy Conservator of Forests, is appointed to officiate as Divisional Forest Officer and posted in charge of the North Mandla Forest Division.

8.—Madras Gazette.

7th July 1924.—No. 211.—Mr. H. F. A. Wood, Conservator of Forests, Fifth Circle, is granted leave on average pay for 8 months, with effect from 12th October 1924.

11th July 1924.—Messrs. P. W. Davis and H. A. H. C. Hicks, Assistant Conservators of Forests, will be attached to the Nilambur Division on the expiry of their leave.

17th July 1924.—No. 215.—Mr. H. E. Brown, Probationary Extra Assistant Conservator of Forests is comfirmed with effect from 30th March 1924.

18th July 1924.—Saiyid Riazuddin Sahib Bahadur, Extra Assistant Conservator of Forests, Kistna, is attached to the South Cuddapah Division.

19th July 1924.—No. 217.—Mr. D. F. Stileman, Deputy Conservator of Forests, has been granted by the High Commissioner for India an extension of leave for 5 days.

25th July 1924.—M. Amir Padsha Sahib Bahadur, Extra Assistant Conservator of Forests, will, on the expiry of his leave, be attached to the South Cuddapah Division.

M.R.Ry. A. V. Sundaram, Extra Assistant Conservator of Forests, is transferred from the South Vellore Division to the South Kurnool Division. To join expeditiously.

29th July 1924.—Under Rule 81 of the Fundamental Rules, Mr. S. K. Basu, Assistant Conservator of Forests, South Mangalore, is granted leave on average pay for one month, with effect from 26th July 1924.

M.R.Ry. P. Govinda Menon, Extra Assistant Conservator of Forests, Nilambur, is granted, in continuation of the one month's privilege leave already granted to him, an extension of leave for seven days, of which four days will be privilege leave and three days leave on half average pay (furlough).

Under Rule 81 of the Fundamental Rules, M.R.Ry. K. G. Belliappa, Extra Assistant Conservator of Forests, is granted in continuation of the leave on average pay for four months and three days, already granted to him, an extension of leave on medical certificate for six months, of which four months leave will be on average pay and two months leave on half average pay.

M. R. Ry. Belliappa's leave salary will be debited to Coorg during the period of the extension of leave now sanctioned.

30th July 1924.—Mr. S. R. Row, Assistant Conservator of Forests, Guntur, is granted leave on average pay for 12 days from or after 25th July 1924.

31st July 1924.—No 223—Mr. A. M. C. Littlewood, Deputy Conservator of Forests, is granted an extension of leave up to 15th August 1924 in continuation of the leave already granted to him by the Chief Conservator of Forests.

9.—Bombay Gazette.

12th/13th July 1924.—No. 2219.—Mr. V. N Hasabnis, Extra Assistant Conservator of Forests in N. D., Kanara, is posted for special duty under the Divisional Forest Officer, Belgaum, for a period of three months from the date of relief.

10.—Burma Gazette.

2nd July 1924.—No. 162.—Under the provisions of Rules 80 and 81 of the Fundamental Rules, leave on average pay for eight months and in continuation thereof leave on half average pay for one year and eight months, for a total period of two years and four months, is granted to Mr. J. J. Rorie, Conservator of Forests, Chindwin Circle, with effect from the 11th August 1924 or the subsequent date on which he avails himself of it.

4th July 1924.—No. 163—Mr. D. E. Belford Manning, Assistant Conservator of Forests, attached to the Ataran Forest Division, is transferred from Moulmein and placed on special duty at Toungoo in connection with the measurement of timber in the North Toungoo Forest Division.

No. 164—Mr E Q. O'Brien Smith, Assistant Conservator of Forests, attached to the South Pegu Forest Division, is transferred from Pegu and placed on special duty at Toungoo in connection with the measurement of timber in the North Toungoo Forest Division.

No. 165.—Mr. H. Hilbert, Extra Assistant Conservator of Forests, attached to the North Pegu Forest Division is transferred from Pegu and posted to duty in the Depôt and Agency Forest Division.

5th July 1924.—No. 166—Mr. H. V. W. Fields-Clarke, Forest Engineer, has been granted by the High Commissioner for India an extension of leave on medical certificate for three months in continuation of the leave granted to him in this Department Notification No. 30, dated the 24th January 1924.

9th July 1924.—No. 167.—Mr. D. T. Griffiths, Assistant Conservator of Forests, attached to the Prome Forest Division, is transferred from Prome and posted to duty in the Shwebo Forest Division.

10th July 1924.—No. 168.—Mr A Long, Extra Assistant Conservator of Forests, on probation, attached to the North Toungoo Forest Division, is transferred from Toungoo and is appointed to be Instructor (Minor), Burma Forest School, Pyinmana, in place of Mr D. Edge, Extra Assistant Conservator of Forests.

No. 169.—Mr D. Edge, Extra Assistant Conservator of Forests, Instructor (Minor), Burma Forest School, Pyinmana, is appointed to be Instructor (Major), in place of Mr. G. P. Walden, Extra Assistant Conservator of Forests, transferred.

No. 170—Mr. G. P. Walden, Extra Assistant Conservator of Forests, Instructor (Major), Burma Forest School, Pyinmana, is transferred from Pyinmana, and posted to the charge of the North Arakan Forest Division, in place of Mr. D A. Allan, Deputy Conservator of Forests, proceeding on leave.

No. 171.—In this Department Notifications Nos. 151 and 152, dated the 12th June 1924, transferring Mr. H. E. Flint to the Working Plans Circle, *for* the words "Assistant Conservator of Forests" *substitute* "Deputy Conservator of Forests."

14th July 1924.—No. 173.—Mr. S. F. Hopwood, Conservator of Forests. Tenasserim Circle, relinquished charge, on the afternoon of the 17th June 1924, of the special duty to which he was posted in this Department Notification No. 160, dated the 30th June 1924.

15th July 1924.—No. 174.—Under the provisions of Rules 80 and 81 of the Foundamental Rules an extension of leave on half average pay for two days is granted to Mr. D. Xavier, Extra Assistant Conservator of Forests, on probation, in continuation of the leave granted to him in this Department Notification No. 43, dated the 11th February 1924.

18th July 1924.—No. 175.—This Department Notifications No 153, dated the 18th June 1924, granting three months' leave on average pay to Mr. Hatim Tai, Extra Assistant Conservator of Forests, in charge of the Magwe Forest Division, and No 154, dated the 18th June 1924, placing of Mr. R. L Pocock, Deputy Conservator of Forests, Minbu Forest Division, in charge of the Magwe Forest Division, as a temporary measure, in addition to his own duties, in place of Hatim Tai, are hereby cancelled.

No. 176.—On return from leave, Maung Win Maw, Extra Assistant Conservator of Forests, is posted to duty in the Henzada-Ma-ubin Forest Division.

19th July 1924.—No. 177.—Under the provisions of the rules contained in Financial Department Notification No 57, dated the 31st December 1921, as amended by the same Department Notifications No. 7, dated the 2nd February 1923, leave on average pay for two months and twenty-one days is granted to Mr R S. Wickham, Senior Timber Assistant (Temporary), Myitmaka Extraction Division, with effect from the afternoon of the 15th June 1924.

Mr. R. S. Wickham's services will terminate on the expiry of this leave.

No. 178.—Under the provisions of the rules contained in Financial Department Notification No 57, dated the 31st December 1921, as amended by the same Department Notification No 7, dated the 2nd February 1923, leave on average pay for four months and five days is granted to Mr. T. W. C. Barnes, Senior Timber Assistant (Temporary), Myitmaka Extraction Division, with effect from the afternoon of the 17th June 1924.

Mr. T. W. C. Barnes' services will terminate on the expiry of this leave.

22nd July 1924.—No. 179.—Under the provisions of Rule 103 (*a*) of the Fundamental Rules and of the Local Government Financial Department Notification No. 57, dated the 31st December 1921, as amended by the same Department Notification No. 7, dated the 2nd February 1923, leave on average pay for four months is granted to Mr. J. B. Renny, Junior Timber Assistant (Temporary, Myitmaka Extraction Division, with effect from the afternoon of the 15th June 1924.

Mr. J. B. Renny's services will terminate on the expiry of this leave.

23rd July 1924.—No. 180.—Mr. D. T. Griffiths, Assistant Conservator o Forests, attached to the Shwebo Forest Division, is placed in charge of that Division, in place of Mr D. P. Hewett, Deputy Conservator of Forests, transferred.

No. 181.—Mr. D. P. Hewett, Deputy Conservator of Forests, who has been appointed to officiate as a Conservator of Forests, is transferred from Shwebo and posted to the charge of the Hlaing Forest Circle, in place of Mr. W. Mayes, Conservator of Forests, transferred to the Punjab.

No. 182.—Mr. H. C. Walker, Conservator of Forests, Northern Circle, is placed in charge of the Chindwin Forest Circle, in addition to his own duties, as a temporary measure, in place of Mr. J J. Rorie, Conservator of Forests, proceeding on leave.

30th July 1924.—No 183.—Under the provisions of Rules 80 and 81 of the Fundamental Rules an extension of leave on half average pay for seven months (on medical certificate) is granted to Mr. F. P. Thomson, Extra Assistant Conservator of Forests, in continuation of the leave granted to him in this Department Notification No. 195, dated the 13th September 1923.

31*st July* 1924.—No. 184.—Mr. H. E. Flint, Deputy Conservator of Forests, attached to the Working Plans Circle, is transferred from Maymyo to Prome and placed on special duty in connection with the measurement of timber in the Prome Forest Division.

No. 185.—Mr. G. D Warwick, Assistant Conservator of Forests, attached to the Zigon Forest Division, is transferred from Tharrawaddy to Prome and placed on special duty in connection with the measurement of timber in the Prome Forest Division.

No. 186.—Mr. P. Meyrick Jones, Assistant Conservator of Forests, attached to the Tharrawaddy Forest Division, is transferred from Tharrawaddy to Prome and placed on special duty in connection with the measurement of timber in the Prome Forest Division.

No 187.—Mr H. V. Tollemache, Assistant Conservator of Forests, attached to the Katha Forest Division, is transferred from Katha to Mandalay and placed on special duty in connection with the measurement of timber in the Mandalay Depôt Forest Division.

No. 188.—Mr. P. N. H. Garnett, Assistant Conservator of Forests, attached to the Maymyo Forest Division, is transferred from Maymyo to Mandalay and placed on special duty in connection with the measurement of timber in the Mandalay Depôt Forest Division.

No. 189.—Mr H H. C. Pudden, Assistant Conservator of Forests, attached to the Shwebo Forest Division, is transferred from Shwebo to Pakokku and placed on special duty in connection with the measurement of timber in the Yaw Forest Division.

2*nd August* 1924.—No. 190.—Mr. F. T. Morehead, Assistant Conservator of Forests, attached to the Ataran Forest Division, is transferred from Moulmein and posted to the charge of the South Toungoo Forest Division, in place of Mr. K. F. R. Dickins, Deputy Conservator of Forests, transferred to the Central Provinces.

4*th August* 1924.—No. 191.—On return from leave, Mr. G. Aubert, Extra Assistant Conservator of Forests, on probation, is posted to duty in the Henzada-Maubin Forest Division.

6*th August* 1924.—No. 192.—Prior to taking over charge of the Hlaing Forest Circle, to which he was posted in this Department Notification No. 181, dated the 23rd July 1924, Mr. D. P. Hewett, Deputy Conservator of Forests, is posted to the office of the Conservator of Forests, Hlaing Circle.

LIST OF BOOKS AND PUBLICATIONS RECEIVED BY THE HONORARY EDITOR DURING THE MONTHS OF JULY-AUGUST 1924.

Industrial India, Vol. 3, No. 11, June 1924 and No 12, July 1924.

Silage—Department of Agriculture, U. P. Allahabad, 1924.

Notes on Upper India Hedges -Department of Agriculture, U. P., Allahabad, 1924.

C. Leary and Company's London Market Reports, 1st to 30th June 1924.

Indian Engineering, Vol LXXVI, Nos 3, 4, 5 and 6, dated 19th and 26th July an 2nd and 9th August 1924.

The Timber Trades Journal. Vol XCVI, Nos. 2496, 2497, 2498 and 2499, dated 28th June and 5th, 12th, and 19th July 1924.

Experiment Station Record, Vol. 50, No 6, Abstract Number, issued 1924.

The Review of Applied Entomology, Series A : Agriculture, and Series B : Medical and Veterinary, Vol. XII, Part 6, June 1924.

The Cypress Knee - Georgia State College of Agriculture, Athens, 1924.

Quarterly Journal of Forestry, Vol. XVIII, No. 3, July 1924.

The Agricultural Journal of India, Vol. XIX, Part IV, July 1924.

Forestry in Brunei and Labaun, 1924.

The Makiling Echo, Vol. III, Nos. 1 and 2, March 1924.

Records of the Geological Survey of India, Vol. LV, Part 4, 1924.

Journal of Forestry, Vol. XXII, No. 5, May 1924.

The Philippine Journal of Sciecne, Vol. 24, No. 5, May 1924.

The Scottish Geographical Magazine, Vol. XL, No. 4, dated 15th July 1924.

Index to the Proceedings of the Madras Legislative Council, (First Session of the Second Legislative Council February 1924) Vol. XVI, 1924.

Allahabad :—Printed and published at the Pioneer Press, by C. G HARRIS,
No. 1165—1-9-24.

GAZETTE NOTIFICATIONS.

1.—Gazette of India.

4th September, 1924—No. 539.—Dr. Shankar Nath Kapur, Ph.D., has been appointed to the post of Assistant to the Officer-in-charge of the Timber Seasoning Section, Forest Reaich Institute and College, Dehra Dun, on probation with effect from the afternoon of the 28th August 1924.

2.—Bengal Gazette.

4th August 1924.—No. 30-*For.*—Mr. R. I. Macalpine, Assistant Conservator of Forests attached to the Kalimpong Division, is transferred to the Sundarbans Division as an attached officer with headquarters at Khulna.

9th August 1924.—No. 31-*For.*—Notification No. 29-For., dated the 30th June 1924, in which leave on average pay for 15 days was granted to Babu Jitendra Nath Sen Gupta, Probationary Extra Assistant Conservator of Forests, is hereby cancelled.

23rd August 1924—No. 7291-*For.*—Babu Paresh Nath Mukharji, Extra Assistant Conservator of Forests, Bengal, is allowed leave, on average pay, under rule 81(*b*) (*ii*) of the Fundamental Rules, on medical certificate, for two months, with effect from the 1st July 1924, in extension of the leave granted to him by the Conservator of Forests, Bengal.

28th August 1924.—No. 32 *For.*—Mr. G. W. Houlding, Forest Engineer, is allowed leave on average pay for one month and 3 days (five days of which are on account of privilege leave at his credit), under article 81 (*b*) (*i*) of the Fundamental Rules, with effect from the 29th August 1924.

He is permitted to affix the Durga Puja holidays to this leave.

No. 33-*For.*—Babu Jnan Prasanna Roy, Extra Assistant Conservator of Forests, is allowed leave on average pay for one month and 14 days, under article 81 (*b*) (*ii*) of the Fundamental Rules, with effect from the forenoon of the 18th August 1924.

He is permitted to affix the Durga Puja holidays to the leave.

3.—Bihar and Orissa Gazette.

19th August 1924.—No. 14-*Forests*—Mr. M. L. Sen Gupta, Assistant Conservator of Forests, attached to the Puri Forest Division, is transferred to the Saranda Forest Division as an attached officer.

30th August 1924.—No. 763—IIIF-4-R. T.—Mr. E. R. Comber, Extra Assistant Conservator of Forests, Bihar and Orissa, is promoted to the Indian Forest Service and appointed to be Deputy Conservator of Forests in the vacancy caused by the retirement of Mr A. H. Mee, with effect from the 25th October 1923.

3rd September 1924—No. 8549—IIIF-165-R.—Mr. C. M. Chaudhuri, Assistant Conservator of Forests, Bihar and Orissa, having arrived at Bombay on the forenoon of 27th November 1922, was permitted to visit his home in the district of Bareilly prior to joining his duties at Sambalpur on the forenoon of 19th December 1922.

Notification No. 5845—IIIF-101 R., dated the 21st June 1923, published in Part I of the *Bihar and Orissa Gazette* of 27th June 1923, is cancelled.

4.—Assam Gazette.

25th July 1924—No 1742-R.—Mr. Atulananda Das, Deputy Conser ator of Forests, is transferred from the Garo Hills to the Lakhimpur Forest Division.

No. 1743-R.—On being relieved by Mr. Atulananda Das, Mr. A R. Thomas, Deputy Conservator of Forests, is transferred from the Lakhimpur to the Garo Hills Division.

No 1744 R.—Pending the arrival of Mr. A. R. Thomas, Babu Chandra Sekhar Purkayastha, Extra Assistant Conservator of Forests, will temporarily hold charge of the Garo Hills Forest Division.

18th August 1924 —2008-R.—On return from leave Captain G. A. Nevill, Political Officer of the Balipara Frontier Tract is appointed to hold charge of the Darrang Forest Division in addition to his own duties, with effect from the afternoon of 31st July 1924

No. 2009-R.—On being relieved by Captain G. A Nevill. Babu Dwijendra Nath De, Extra Assistant Conservator of Forests, is attached to the Darrang Forest Division.

5.—United Provinces Gazette.

9th August 1924 —No. 29.—This office Notification No. 24, dated the 9th July, 1924 is hereby cancelled.

16th August 1924 —No. 30.—Muhammad Shah Nawaz Khan, Extra Assistant Conservator of Forests attached to the Bahraich Forest Division in the Eastern Circle, is transferred to the charge of the Banda Forest Division in the same Circle

20th August 1924.—No. 31 —Thakur Bashi Ram Extra Assistant Conservator of Forests, on return from leave, is posted to the Ramnagar Forest Division in the Western Circle as an attached officer.

5th September 1924 —No. 867 —Mr. H G Billson, F. C. H., Chief Conservator of Forests, United Provinces is granted leave on average pay for eight months followed by leave on half average pay for four months, with effect from the 10th October 1924.

6.—Punjab Gazette.

15th August 1924.—No. 19468-*Forests* —Mr. Partab Singh. Assistant Conservator of Forests, attached to the Rawalpindi East Division, is transferred to Rawalpindi West Division, as an attached officer with head quarters at Ghoragali, with effect from 15th July 1924, afternoon.

23rd August 1924.—No. 19959-Forests.—L. Mul Chand, Extra Assitant Conservator of Forests, on probation, is promoted to Extra Assistant Conservator of Forests, with effect from 1st July 1924.

Mr. Balwant Singh, Probationary Extra Assistant Conservator of Forests, is promoted to Extra Assistant Conservator of Forests, with effect from 1st April 1924.

30th August 1924.—No. 15.—S. Narinjan Singh, Extra Assistant Conservator of Forests, attached to the Rawalpindi East Division (Western Circle), is transferred to Jhelum Forest Division as an attached officer, with head quarters at Sodhi Jai Wali, with effect from 21st August 1924 (forenoon).

7.—Central Provinces Gazette.

18th August 1924 —No. 3152-1620-III.—Under rule 81 (*b*) (ii) of the Fundamental Rules, leave on average pay for one month and nine days is granted to Mr. Balkrishna Dinkar Ukidwe, Extra Assistant Conservator of Forests, in charge of the North Raipur Forest Division with effect from the 24th August 1924, or the subsequent date from which he avails himself of it.

No. 3152-1620-III.—Mr. Dhanraj Dutt, Extra Assistant Conservator of Forests, in charge of the South Raipur Forest Division, is appointed to hold charge of the

North Raipur Forest Division, in addition to his own duties, *vice* Mr. Ukidwe, proceeding on leave.

25th August 1924.—No 3291-1684 III.—On return from leave, Mr. W. A. Muir, Deputy Conservator of Forests, is appointed to officiate as Divisional Forest Officer and posted in charge of the South Mandla Forest Division.

Order No. 3015-1577-III, dated the 7th August 1924, is hereby cancelled.

8.—Madras Gazette.

31st July 1924.—Under rule 81 of the Fundamental Rules, M.R Ry. V. Narayana Ayyar, District Forest Officer, Guntur, is granted leave on average pay for 3 months on relief by Mr. A. M. C. Littlewood.

5th August 1924.—No. 233.—The following postings of Forest Officers are ordered:—

Saiyid ud-din Ahmad Sahib Bahadur, Extra Assistant Conservator of Forests on return from leave, to be District Forest Officer, Palghat.

Mr. Roland Henry Mitchel, District Forest Officer, Bellary, to be Senior Instructor, Madras Forest College, *vice* Mr. J. E. Mitchell.

M.R.Ry. V Narayana Ayyar Avargal, District Forest Officer, North Cuddapah, to be District Forest Officer, Guntur, *vice* Mr. C. J. Van Haefton.

6th August 1924.—M.R.Ry. E. V. Padmanabha Pillai Avargal, District Forest Officer, South Kurnool, to be District Forest Officer, Central Salem, *vice* M.R.Ry. A. Raju Nayakkar Avargal granted leave.

M.R.Ry. S. Ramaswami Ayyar Avargal Extra Assistant Conservator of Forests, to be District Forest Officer, South Kurnool, *vice* M.R.Ry. E. V. Padmanabha Pillai Avargal.

Mr. H. P. Ward, Assistant Conservator of Forests, doing duty under the Forest Utilization Officer, to be Forest Utilization Officer, *vice* Mr. J. W. K. Wernham on deputation.

Mr. M. F. Bridge, Deputy Conservator of Forests, doing duty under the Forest Utilization Officer, to be on special duty under the Chief Forest Engineer.

Mr. J. E. Mitchell, Assistant Conservator of Forests, on relief in the Forest College, will be attached to the South Coimbatore Division.

No. 230.—M.R.Ry. A. Raju Nayakkar Avargal, District Forest Officer, Central Salem, is granted leave on average pay for one month and a half, with effect from the date of relief.

8th August 1924.—No. 231.—Mr. G. C. Robinson, District Forest Officer, Nilambur, is granted leave on average pay for eight months and in continuation thereof leave on half average pay for four months, with effect from or after 15th August 1924.

11th August 1924.—No. 238.—Mr. A. Wimbush, Deputy Conservator of Forests, has been granted by the High Commissioner for India an extension of leave for 14 days.

Muhammad Abdul Hafiz Sahib Bahadur, District Forest Officer, East Kurnool, is granted leave on average pay for one month, with effect from 15th August 1924.

M.R.Ry. M. Srinivasaraghava Acharya, Extra Assistant Conservator of Forests, West Kurnool Division, to be in charge of the East Kurnool Division, during the absence of Muhammad Abdul Hafiz Sahib Bahadur on leave or until further orders.

16th August 1924.—No. 240.—The following appointments and postings of Forest Officers are ordered:—

Mr. A. Wimbush, Deputy Conservator of Forests, on return from leave, to act as Conservator of Forests, V Circle, *vice* Mr. H. F. A. Wood granted leave.

Mr. C. C. Wilson, Deputy Conservator of Forests, on return from leave, to act as Conservator of Forests, II Circle, *vice* Mr. T. Clear.

Mr. T. Clear, Acting Conservator of Forests, II Circle, on relief by Mr. C. C. Wilson, to be District Forest Officer, East Salem.

No 241.—The following postings of Forest Officers are ordered :—

Mr. D. M. Currie, District Forest Officer, the Nilgiris, to special duty under the Conservator of Forests, VI Circle, with effect from or after 21st July 1924.

Mr. P. W. Davies, Assistant Conservator of Forests, to be District Forest Officer, Nilambur, *vice* Mr. G. C. Robinson granted leave.

Mr. D. F. Stileman, Deputy Conservator of Forests, on return from leave, to be District Forest Officer, Nilambur, *vice* Mr. P. W. Davies.

22nd August 1924.—No. 252.—The following posting of a Forest Officer is ordered :—

Mr. D. M. Currie, Deputy Conservator of Forests working under the Conservator of Forests, VI Circle, to be Working Plan Officer, Manantoddy, with effect from or after 11th August 1924.

26th August 1924.—Mr. M. C. Chandy, District Forest Officer, East Salem, will, on relief by Mr. T. Clear, be attached to the East Salem Division.

29th August 1924.—Mr. C. J. Van Haeften, Extra Assistant Conservator of Forests, on return from leave, is posted for duty under the Chief Forest Engineer.

4th September 1924.—Mr. M. F. Bridge, Deputy Conservator of Forests, on special duty under the Chief Forest Engineer, is granted leave on average pay for three weeks, with effect from 22nd August 1924.

Mr. B. K. Roy, District Forest Officer, South Cuddapah, is granted leave on average pay for six weeks, with effect from 28th September 1924.

Saiyid Riaz-ud-din Sahib Bahadur, Extra Assistant Conservator of Forests, South Cuddapah Division, to be in charge of the South Cuddapah Division during the absence of Mr. B. K. Roy on leave.

9.—Bombay Gazette.

13th August 1924.—No. S 20/10/12857-D.—In supersession of the previous notifications the leave granted to Mr. F. X. Saldanha, Extra Assistant Conservator Forests, should be treated as under :—

Privilege leave—23rd September to 31st December 1921.

Leave on average pay—1st January to 8th February 1922.

Leave on half average pay—9th February 1922 to 18th August 1923.

Mr. Saldanha is granted an extension of leave on half average pay for the period of his absence for eleven days from 19th to 29th August 1923.

10.—Burma Gazette.

11th August 1924.—No. 193.—Mr. A. L. George, Extra Assistant Conservator of Forests, attached to the Henzada-Ma-ubin Forest Division, is placed under suspension, with effect from the afternoon of the 31st July 1924.

13th August 1924.—No. 194.—The following Extra Assistant Conservators of Forests, on probation, are confirmed in their appointments, with effect from the dates specified against each of their names :—

1.	Maung Ba Zan	... 30th March 1924.
2.	Mr. D. W. D'Silva	... 30th March 1924.
3.	Maung Hla Min	... 1st July 1924.
4.	Mr. A. Long	... 1st July 1924.
5.	Maung Tun Hla	... 1st July 1924.
6.	Mr. E. A. D'Silva	... 1st July 1924.

No. 195.—Mr. B O. Johannes, officiating Extra Assistant Conservator of Forests, is confirmed in his appointment, with effect from the 7th June 1924.

19th August 1924.—No 196 —Mr J J. Rorie, Conservator of Forests, made over, and Mr. H. C. Walker, Conservator of Forests, Northern Circle, received charge of the Chindwin Circle, in addition to his own duties, as a temporary measure, on the 11th August 1924, before moon.

No 197 —Mr. G. H. Ogilvie, Deputy Conservator of Forests, has been granted by the High Commissioner for India an extension of leave on half average pay for 7 days in continuation of the leave granted to him in this Department Notification No. 12, dated the 7th January 1924, as amended by Notification No 39, dated the 6th February 1924.

21st August 1924.—No. 198.—Mr. A. N. Barker, Assistant Conservator of Forests, attached to the Tharrawaddy Forest Division, is transferred from Tharrawaddy and posted to duty in the Working Plans Circle, with head quarters at Maymyo.

22nd August 1924. —No 201 —Under the provisions of Rules 80 and 81 of the Fundamental Rules, leave on average pay for eight months and in continuation thereof, leave on half average pay for five months, for a total period of one year and one month, is granted to Mr R. Unwin, Deputy Conservator of Forests and Professor of Forestry, University College, Rangoon, with effect from the 29th September 1924, or the subsequent date on which he avails himself of it.

From the date on which he avails himself of the leave, Mr. Unwin reverts to the Forest Department.

26th August 1924. —No. 202.—Mr. W. Mayes, Conservator of Forests, made over, and Mr. D. P. Hewett, Officiating Conservator of Forests, received, charge of the Hlaing Circle on the 20th August 1924, afternoon.

4th September 1924 —No. 205.—Mr. A. Hyde-Johnson, Deputy Conservator of Forests, attached to the Insein Forest Division, is transferred from Insein and posted to duty in the Prome Forest Division, with headquarters at Prome.

LIST OF BOOKS AND PUBLICATIONS RECEIVED BY THE HONORARY EDITOR DURING THE MONTHS OF AUGUST-SEPTEMBER 1924.

The Australian Forestry Journal, Vol VII ; No. 6, June 1924.

Indian Engineering, Vol LXXVI. Nos. 7, 8, 9, 10 and 11, dated 16th, 23rd and 30th August and 6th and 13th September 1924.

The Timber Trades Journal, Vol. XCVI, Nos. 2500, 2501, 2503 and 2504, dated 26th July and 2nd, 16th and 23rd August 1924.

The Tropical Agriculturist, Vol. LXIII, No. 1, July 1924 and No. 2, August 1924.

The Review of Applied Entomology Series A. Agricultural, and Series B. Medical and Veterinary, Vol. XII, Part 7. July 1924.

Revue des Eaux et Forests, Vol. LXII, No 7, July 1924.

Forest Tree Planting—Department of Lands and Forests, Ontario, Forestry Branch, Bulletin No 1, January 1924.

The Preservative Treatment of Fence Posts—Department of the Interior, Canada Forestry Branch. Circular No. 16.

Hemlock—Department of the Interior, Canada, Forestry Branch, Tree Pamphlet No. 4, 1923.

Western Hemlock—Department of the Interior, Canada, Forestry Branch, Tree Pamphlet No 5, 1924.

Report of the Director of Forestry, Department of the Interior, Canada, for the fiscal year ended 31st March 1923.

Birds of an Indian Garden by T. Bainbrigge Fletcher and C. M. Inglis, Part I.

C. Leary and Company's London Market Reports, 1st to 31st July 1924.

Experiment Station Record, Vol. 50, No. 7, May 1924, No 8, June 1924 and No. 9 Abstract Number, issued July 1924.

Forest Club Quarterly, Vol. III No 2, June 1924. The University of Washington.

Index to the proceedings of the Madras Legislative Council, Vol. XVII, March 1924.

Annual Report of the Forest Department of Travancore for 1098 M. E (1922–23 A.D.).

The Cyprus Agriculture Journal, Vol. XIX, Part 3, July 1924.

Studies in Indian Tobaccos—No. 4, Parthenocarpy and Parthenogenesis in two varieties of *Nicotiana tabacum*, and No. 5, the inheritance of characters in *Nicotiana rustica*—Memoirs of the Department of Agriculture in India, Botanical Series. Vol. XIII, No 1, June 1924.

Studies in the Indian Fibre Plants—No. 3, on the inheritance of characters in *Hibiscus sabdariffa*—Memoirs of the Department of Agriculture in India, Botanical Series, Vol XIII, No. 3, June 1924.

Annual Report of the Forest Department, Sarawak, for the year 1923.

Allahabad :—Printed and published at the Pioneer Press, by C. G. HARRIS.
No. 1322—1-10-24.

GAZETTE NOTIFICATIONS.

1.—Gazette of India.

5th September 1924.—No. 545.—Consequent on the grant of leave to Mr. J. J. Rorie, Conservator of Forests, Mr. D P. Hewett, Deputy Conservator of Forests, is appointed to officiate as Conservator of Forests in Burma, with effect from the afternoon of 20th August 1924.

11th September 1924.—No. 562.—Mr. K. F. R. Dickins, Deputy Conservator of Forests, Burma, is transferred to the Central Provinces, with effect from the 31st August 1924.

13th September 1924.—No. 573.—Mr. R. N. Parker, Officiating Conservator of Forests, Punjab, whose services have been placed at the disposal of the Government of India, is appointed Systematic Botanist at the Forest Research Institute and College, Dehra Dun, with effect from the afternoon of the 4th September 1924. Mr. Parker is also appointed to officiate as Forest Botanist from the same date and also continues to officiate as Conservator of Forests.

Mr. P. C. Kanjilal, officiating Forest Botanist at the Forest Research Institute and College, Dehra Dun, on relief by Mr. R. N. Parker is appointed to officiate as Oecological Botanist.

16th September 1924.—No. 580.—Lala Parma Nand, Extra Assistant Conservator of Forests, Punjab, whose services have been placed at the disposal of the Government of India by the local Government is deputed to the post of an Upper Grade Assistant in the Sylvicultural Branch of the Forest Research Institute and College, Dehra Dun, for a period of two years, with effect from the forenoon of the 25th August 1924.

19th September 1924.—No. 594.—Consequent on the retirement of Mr. J. W. A. Grieve, Chief Conservator of Forests, Punjab, Mr. W. Mayes, Conservator of Forests, on transfer from Burma, is promoted to be Chief Conservator of Forests, Punjab, with effect from the forenoon of the 1st September 1924.

From the same date Mr. A. D. Blascheck, officiating Chief Conservator of Forests, Punjab, reverted to the class of Conservators of Forests in the Punjab.

Mr. F. W. Collings, Deputy Conservator of Forests, Burma (on leave), is promoted to be Conservator of Forests, with effect from the forenoon of 1st September 1924.

2.—Bengal Gazette.

10th September 1924.—No. 34-*For.*—On return from the leave granted to him in this Department Notification No. 27-For., dated the 10th June 1924, and in Government of Bengal, Revenue Department, Notification No. 7291-For., dated the 23rd August 1924. Babu Paresh Nath Mukharji, Extra Assistant Conservator of Forests, is posted to th Sundarbans Division as an attached officer with headquarters at Khulna.

3.—Bihar and Orissa Gazette.

27th September 1924.—No. 15-Forests.—Maulavi Saiyid Manzur Ahsan, Extra Assistant Conservator of Forests, attached to the Porahat Forest Division, is granted, under Fundamental Rules 77 and 81, leave on average pay for ten days from the 16th September 1924.

30th September 1924.—No. 16-Forests.—Mr. O. A. Dodsworth, Extra Assistant Conservator of Forests in charge of the Puri Forest Division, is transferred to the charge of the Kolhan Forest Division.

On relief by Mr. Dodsworth, Mr. E. R. Comber, Deputy Conservator of Forests, in charge of the Kolhan Forest Division, is transferred to the charge of the Puri Forest Division.

4.—Assam Gazette.

30th August 1924.—No. 2145-R.—Babu Jyotirindra Nath Das, Extra Assistant Conservator of Forests, is temporarily transferred from Lakhimpur to the Khasi and Jaintia Hills Division.

11th September 1924.—No. 2254-R.—Mr. N. L. Bor, Deputy Conservator of Forests, is transferred from Naga Hills and placed in charge of the Kamrup Forest Division, with effect from the 9th August 1924, *vice* Mr J. S. Owden on leave.

17th September 1924.—No 2308R.--Babu Narendra Nath Das, Extra Assistant Conservator of Forests, is granted combined leave for one month and twenty-three days, *viz.*, leave on average pay for one month and ten days and leave on half average pay for thirteen days, under rule 81 of the Fundamental Rules, in extension of the leave granted in Notification No. 1035-R., dated the 5th May 1924.

5.—United Provinces Gazette.

13th September 1924.—No. 34.—Babu Chandra Mohan Johri, Extra Assistant Conservator of Forests, attached to the Kalagarh Forest Division in the Western Circle, is granted leave on average pay for twenty days, from the 15th September 1924 or subsequent date.

19th September 1924.—No. 35.—Pandit Urbi Dat Naithani, Extra Assistant Conservator of Forests, on return from leave is posted to the Ramnagar Forest Division in the Western Circle as an attached officer.

30th September 1924.—No. 36.—Mr. Manohar Das Chaturvedi, Assistant Conservator of Forests, attached to the Direction Division, Working Plans Circle, is transferred to the Gorakhpur Forest Division in the Eastern Circle as an attached officer.

6.—Punjab Gazette.

29th September 1924.—No. 21836.—Mr. W. G. Pring, Assistant Conservator of Forests, attached to the Kulu Forest Division, is transferred to the Kangra Forest Division, with headquarters at Dharamsala, with effect from the forenoon of the 28th August 1924.

7.—Central Provinces Gazette.

15th September 1924.—No. 3540-1804-III.—Mr. W. A. Muir, Deputy Conservator of Forests, was attached to the South Mandla Division for the 20th August 1924.

No. 3548-1202-III.—Mr. F. J. Langhorne, Extra Assistant Conservator of Forests, is promoted to the Imperial Forest Service, as Deputy Conservator of Forests, with effect from the 27th August 1924.

18th September 1924.—No. 3571-1847-III.—Mr. G. M. Townshend, Deputy Conservator of Forests, Central Provinces, has been granted, by the High Commissioner for India, leave on medical certificate for three months, in extension of the leave granted to him by Order No. 1724-869-III, dated the 28th April 1924.

24th September 1924.—No. 3631-1877-III.—Mr. K. F. R. Dickins, Deputy Conservator of Forests, Burma, whose services have been placed at the disposal of this Government, with effect from the 31st August 1924, is posted to the South Chanda Division, as attached officer.

8th October 1924.—No. 3803-1953-III.—Mr. M. Narsingh Rao, M.B.E., Extra Assistant Conservator of Forests, is promoted to the Imperial Forest Service as Deputy Conservator of Forests, with effect from the 10th September 1924.

8.—Madras Gazette.

3rd September 1924.—Mr. M. F. Bridge, Deputy Conservator of Fores s, on specia duty under the Chief Engineer, is granted leave on average pay for three weeks with effect from 22nd August 1924.

10th September 1924.—Mr. J. C. Wrench, Assistant Conservator of Forests, Bellary to special duty in the Chittoor District under the orders of the Conservator of Forests, 3rd Circle, Madras.

15th September 1924.—Mr. K. T. Mathew, Assistant Conservator of Forests, on probation, is posted for duty under the Chief Forest Engineer.

22nd September 1924.—No. 284.—Mr. T. Clear, Acting Conservator of Forests, 2nd Circle, is granted leave on average pay for six weeks with effect from the date of relief by Mr. C. C. Wilson.

30th September 1924.—No. 291.—The following posting of a Forest Officer is ordered:—

M.R.Ry. A. Raju Nayakkar Avargal, Extra Assistant Conservator of Forests on return from leave, to be District Forest Officer, South Kurnool.

9.—Bombay Gazette.

12th September 1924.—No. S. 20/10/14319.—Mr. W. E. Copleston, C.S.I., Chief Conservator of Forests, Bombay Presidency, is granted, with effect from 11th October 1924 or the subsequent date on which he may be relieved, leave on average pay for eighl months combined with leave on half average pay for such period as may bring the totaf period of absence up to 1st February 1927.

No. S. 20/10/15631.—The Governor with the concurrence of the Minister is pleased to appoint Mr. A. G. Edie, on return from leave, to act as Chief Conservator of Forests, Bombay Presidency, *vice* Mr. W. E. Copleston, C.S.I., proceeding on leave, pending further orders.

13th September 1924.—No. 2136.—Leave on average pay for 14 days is granted to Mr. J. Petty, Assistant Conservator of Forests, E. D., Kanara, with effect from 3rd September 1924.

25th September 1924.—No. S. 20/10/16040.—Mr. J. Walker, Divisional Forest Officer, Hyderabad, is granted leave on average pay for 17 days, with effect from 4th September 1924.

The Governor with the concurrence of the Minister is pleased to appoint Mr. J. A. Singh, Assistant Conservator of Forests, to act as Divisional Forest Officer, Hyderabad, *vice* Mr. J. Walker, proceeded on leave.

10.—Burma Gazette.

5th September 1924.—No. 206.—The services of Mr. K. F. R. Dickins, Deputy Conservator of Forests, Burma, are temporarily placed at the disposal of the Government of the Central Provinces, with effect from the 31st August 1924.

9th September 1924.—No. 208.—Mr. D. E. Belford Manning, Assistant Conservator of Forests, attached to the North Toungoo Forest Division, is transferred from Toungoo and placed on special duty at Pakôkku in connection with the measurement of timber n the Yaw Forest Division.

No. 209.—Mr. P. N. H. Garnett, Assistant Conservator of Forests, attached to the Mandalay Depôt Forest Division, is transferred from Mandalay and placed on special duty at Pakôkku in connection with the measurement of timber in the Yaw Forest Division.

No. 210.—Mr. A. N. Barker, Assistant Conservator of Forests, attached to the Working Plans Circle, is transferred from Maymyo and placed on special duty at Mandalay in connection with the measurement of timber in the Mandalay Depôt Forest Division.

No. 211.—Mr T. C. D. Ricketts, Assistant Conservator of Forests, attached to the Working Plans Circle, is transferred from Moulmein and placed on special duty at Mandalay in connection with the measurement of timber in the Mandalay Depôt Forest Division.

No. 212.—Mr. R. J. Sayers, Assistant Conservator of Forests, attached to the Working Plans Circle, is transferred from Prome and placed on special duty at Mandalay in connection with the measurement of timber in the Mandalay Depôt Forest Division.

19th September 1924.—No. 220.—Under the provisions of rules 80 and 81 of the Fundamental Rules, leave on average pay for eight months is granted to Mr. J. Todd, Deputy Conservator of Forests, in charge of the Möngmit Forest Division, with effect from the 14th September 1924 or the subsequent date on which he avails himself of it.

No. 221.—Mr. W. T. T. McHarg, Deputy Conservator of Forests, in charge of the Mogôk Forest Division, is placed in charge of the Möngmit Forest Division as a temporary measure, in addition to his own duties, in place of Mr. J. Todd, Deputy Conservator of Forests, proceeding on leave.

20th September 1924.—No. 222.—Mr. H. V. W. Fields-Clarke, Forest Engineer, has been granted by the High Commissioner for India an extension of leave on medical certificate for three months in continuation of the leave granted to him in this Department Notification No. 166, dated the 5th July 1924.

25th September 1924.—No. 223.—The Government of Burma (Ministry of Forests) promotes Maung Tha Khin, Ranger, 1st grade, and Maung Sein, Ranger, 2nd grade, to be Extra Assistant Conservators of Forests, on probation, with effect form the 1st July 1924.

26th September 1924.—No. 224.—Under the provisions of Rules 80 and 81 of the Fundamental Rules, leave on average pay for 14 days is granted to Mr. A. Long, Extra Assistant Conservator of Forests and Instructor (Minor), Burma Forest School, Pyinmana, with effect from the 27th September 1924.

Mr. Long is permitted to affix to his leave the gazetted holidays from 11th to 20th October 1924, both days inclusive.

29 h September 1924.—No. 225.—Mr. A. L. George, Extra Assistant Conservator of Forests, is dismissed from Government service with effect from the 19th September 1924.

No. 226.—Mr. G. W. M. Woods, Assistant Conservator of Forests, attached to the Prome Forests Division, is transferred from Prome and posted to duty in the Insein Forest Divison, with headquarters at Insein.

No. 227.—This Department Notification No. 184, dated the 31st July 1924, transferring Mr. H. E. Flint, Deputy Conservator of Forests, from Working Plans Circle and placing him on special duty in connection with the measurement of timber in the Prome Forest Division, is hereby cancelled.

LIST OF BOOKS AND PUBLICATIONS RECEIVED BY THE HONORARY EDITOR DURING THE MONTHS OF SEPTEMBER-OCTOBER 1924.

Indian Engineering, Vol. LXXVI, Nos. 12, 13, 14 & 15 dated 20th & 27th September and 4th & 11th October 1924.

The Timber Trades Journal, Vol. XCVI, Nos. 2505, 2506, 2507 & 2508, dated 30th August, and 6th, 13th and 20th September 1924.

Revue des Eaux et Forets, Vol. LXII, No. 8, August 1924 and No. 9, September 1924.

The Australian Forestry Journal, Vol. VII, No. 7, July 1924.

The Review of Applied Entomology, Series A: Agricultural, Vol. XI, Title-page and Index, issued August 1924.

The Review of Applied Entomology, Series A: Agricultural, and Series B: Medical and Veterinary, Vol. XII, Part 8, August 1924.

Pear Pollination Agricultural Experiment Station, Berkeley, California, Bulletin No. 373, December 1923.

Index to the Proceedings of the Madras Legislative Council, First Session of the Second Legislative Council, March and April 1924, Vol. XVIII.

C. Leary and Co's London Market Reports, 1st to 31st August 1924.

The Agricultural Journal of India, Vol. XIX, Part V, September 1924.

Proceeding of the Legislative Council of the Governor of Madras, Vol. XIX, No. 1, dated 18th August 1924, No. 2, dated 19th August 1924 and No. 3, dated 20th August 1924.

Annual Progress Report of Forest Administration in the Province of Bihar and Orissa for the year 1923-24.

Empire Forestry Journal, Vol. III, No. 1, July 1924.

Experiment Station Record, Vol. 51, No. 1, July 1924.

The Tropical Agriculturist, Vol. LXIII, No. 3, September 1924.

Some digestibility trials on Indian Feeding Stuffs—Memoirs of the Department of Agriculture in India, Chemical Series, Vol. VII, No. 4, September 1924.

Allahabad :—Printed and published at the Pioneer Press, by C. G. HARRIS,
No. 1482—1-11-24.

GAZETTE NOTIFICATION.

1.—Gazette of India.

9th October 1924.—No 643.—Mr. M. C. Bonington, Deputy Conservator of Forests and Divisional Forest Officer, South Andaman, has been appointed to hold charge of the North Andamans Division in addition to his own duties, with effect from the afternoon of the 18th June 1924, the date from which Mr. R. B. Cornwell proceeded on leave, up to the date on which Mr. C. T. Trigg, Deputy Conservator of Forests, assumes charge of the duties in the North Andaman Division.

16th October 1924.—No. 662.—In continuation of the notification of this Department No. 342, dated the 3rd July 1924, Mr. F. A. Seager, attached officer in the Andamans Forest Department, proceeded on leave with effect from the forenoon of the 18th August 1924 and returned to duty on the forenoon of the 30th September 1924.

The unexpired portion of the leave referred to in the notification quoted above is hereby cancelled.

No 664.—Mr J. Homfray, Officiating Conservator of Forests, Bengal, reverted to his substantive appointment of Deputy Conservator of Forests, with effect from the forenoon of 1st October 1924. From the same date Mr. E. O. Shebbear, Deputy Conservator of Forests, is appointed to officiate as Conservator of Forests, Bengal.

22nd October 1924.—No. 676.—The services of Mr. M Gopal Rau, M.A., Assistant to the Forest Chemist, Forest Research Institute and College, Dehra Dun are lent to the Managing Committee of the Khalsa College, Amritsar, for a period of three months, with effect from the afternoon of the 13th September 1924.

30th October 1924.—No 692.—Mr. R. B. Cornwell, Deputy Conservator of Forests and Divisional Forest Officer, North Andaman Division, has been transferred to Dehra Dun as Instructor at the Forest Research Institute and College, Dehra Dun, where he assumed charge of his duties on the afternoon of the 16th September 1925. The expired portion of the leave granted to him in this Department Notification No. 423, dated the 31st July 1924, is hereby cancelled.

Mr. C. T. Trigg, Instructor at the Forest Research Institute and College, Dehra Dun, has been transferred to the Andamans where he took over charge of the South Andaman Forest Division on the 9th October 1924 from Mr. M. C. Bonington who was appointed to hold charge of the North Andaman Division in addition to his own duties as Divisional Forest Officer, South Andmans, *vide* this Department Notification No. 643, dated the 9th October 1924. Mr. Bonington will continue to hold charge of the North Andaman Division, with effect from the 9th October 1924.

2.—Bengal Gazette.

29th September 1924.—No 35 *For.*—Mr. G. W. Houlding, Forest Engineer, having returned to duty on the forenoon of the 27th September 1924, the unexpired portion, *viz.*, five days, of the leave granted to him in Notification No. 32-For., dated the 28th August 1924, is cancelled.

1st October 1924.—No 36-*For.*—On relief by Mr. J. Homfray, Deputy Conservator of Forests, of the charge of the Jalpaiguri Division, Mr. D. A. G. Davidson, Assistant Conservator of Forests, is attached to that division with headquarters at Jalpaiguri.

No. 578*T.R.*—Babu Priya Nath Sarkar, Extra Assistant Conservator of Forests is allowed leave, under the proviso to article 81(*b*) (*ii*) of the Fundamental Rules, on average pay on medical certificate, for four months with effect from the 9th September 1924, in extension of the leave granted to him in Government Notification No. 5361-For,, dated the 11th June 1924.

11th October 1924 —No. 37-*For* —On return from the leave granted to him in this Department Notification No. 28-For., dated the 30th June 1924, Babu Bhola Nath Bhattacharji, Extra Assistant Conservator of Forests, is posted to the charge of the Lower Tondu Range, Jalpaiguri Division, with headquarters at Ramshaihat.

3.—Bihar and Orissa Gazette.

3rd November 1924.—No 10092-IIIF-210-R.—Captain E. G. Baxter, Provincial Forest Engineer, is granted leave for twelve months, *viz*, leave on average pay for four months and leave on half average pay for the remaining period under Fundamental Rule 81 *b*), with effect from the 24th November 1924 or any subsequent date on which he may avail himself of it.

4 —Assam Gazette.

9th October 1924.—No. 2465R.- Mr. R. N. De, Extra Assistant Conservator of Foreats, Assam, is granted an extension of leave for 7 days from 19th December 1924.

5.—United Provinces Gazette.

2na October 1924 —No. 37.—Mr. G. O. Coombs, Deputy Conservator of Forests, on return form leave, is posted to the charge of the South Kheri Forest Division in the Eastern Circle.

No. 38.—Mr J .Stephens, Assistant Conservator of Forests, on relief of the South Kheri Forest division in the Eastern Circle, is transferred to the charge of the Bahraich Working Plan Division in the Working Plan and Research Circle.

10th October 1924.—No. 39.—Mr. E. W. Raynor, Assistant Conservator of Forests attached to the Ramnagar Forest Division in the Western Circle, is transferred to the Silviculture Division in the Working Plans and Research Circle as an attached officer.

11th October 1924.—No. 40.—Mr. R. N. Singh, Assistant Conservator of Forests, on being relieved of the charge of the Gonda Forest Division in the Eastern Circle, is transferred to the North Kheri Forest Division in the same Circle as an attached officer.

No. 41.—Mr. R. N. Brahmawar, Assistant Conservator of Forests attached to the Direction Division, Western Circle, is transferred to the Haldwani Forest Division in the same Circle as an attached officer.

No. 42.—Babu Kali Charan, Extra Assistant Conservator of Forests attached to the Pilibhit Forest Division in the Eastern Circle, is transferred to the Haldwani Forest Division in the Western Circle as an attached officer.

No. 43.—Saiyid Zainul Ibad Rizvi, Extra Assistant Conservator of Forests attached to the Haldwani Forest Division in the Western Circle, is trasferred to the Pilibhit Forest Division in the Eastern Circle as an attached officer.

No. 44.—Babu Chandra Mohan Johri, Extra Assistant Conservator of Forests, attached to the Kalagarh Forest Division in the Western Circle, is transferred to the Chakrata Forest Division in the same Circle as an attached officer.

No. 45.—Mr. J. C. Ford Robertson, Assistant Conservator of Forests attached to the Lansdowne Forest Division in the Western Cirele is transferred to the Dehra Dun Forest Division in the same Circle as an attached officer.

No. 46.—Pandit Dharni Dhar Joshi, Extra Assistant Conservator of Forests attached to the Dehra Dun Forest Division in the Western Circle, is transferred to the Chakrata Forest Division in the same Circle as an attached officer.

No. 47.—Babu Madan Mohan Singh, Extra Assistant Conservator of Forests attached to the Chakrata Forest Division in the Western Circle, is transferred to the Gorakhpur Forest Division in the Easterd Circle as an attached officer.

No. 48.—Thakur Bashi Ram, Extra Assistant Conservator of Forests attached to the Ramnagar Forest Division in the Western Circle, is posted to the charge of the same Division.

30th October 1924.—No. 51.—Mr. G. O. Coombs, Deputy Conservator of Forests, on return from leave, remained attached to the South Kheri Forest Division in the Eastern Circle from the 15th to 19th October, 1924 (both days inclusive).

No 52.—Mr. W. A. Bailey, Deputy Conservator of Forests, on return from leave, is posted to the charge of the Dehra Dun Forest Division in the Western Circle.

No. 53.—Pandit Tula Ram, Extra Assistant Conservator of Forests in charge of the Dehra Dun Forest Division, in the Western Circle on relief is ransferred to the charge of the Banda Forest Division in the Eastern Circle.

No. 34.—Muhammad Shah Nawaz Khan, Extra Assistant Conservator of Forests, in charge of the Banda Forest Division in the Eastern Circle, on relief is transferred to the Bahraich Forest Division as an attached officer.

No. 55.—Mr. B. R. Wood, Deputy Conservator of Forests, in charge of the Gorakhpur Working Plan Division in the Working Plan Circle, is reposted to the charge of the Gorakhpur Forest Division in the Eastern Circle.

No 56.—Mr. W F Coombs, Extra Assistant Conservator of Forests, in charge of the Gorakhpur Forest Division in the Eastern Circle, is reposted to that Division as an attached officer.

No 57.—Lala Suraj Bhan Bhatia, Extra Assistant Conservator of Forests, in charge of the East Almora Forest Division and also in charge of the East Almora Working Plan Division, is granted leave on full average pay for two months from the 1st November 1924, or subsequent date.

No. 58.—Mr. J. E. C. Turner, Deputy Conservator of Forests, in charge of the Central Almora Division in the Kumaun Circle, to hold charge of the East Almora Division in addition.

6.—Punjab Gazette.

18th October 1924.—No. 16.—Mr E. Owen Williams, Forest Engineer, is granted leave on average pay (including 6 days' privilege leave) under rule 81 of Fundamental Rules for 1 month and 18 days, with effect from 15th September 1924, (forenoon.)

24th October 1924.—No. 17.—S. Narinjan Singh, Extra Assistant Conservator of Forests attached to the Jhelum Forest Division, is transferred to Multan Forest Division as an attached officer with headquarters at Mailsi, with effect from 7th October 1924, (afternoon).

3rd November 1924.—No. 18.—M Muhammad Afzal, Extra Assistant Conservator of Forests, posted to Depôt East Division (Utilization Circle) as an attached officer with headquarters at Doraha, with effect from 18th October 1924, (afternoon) on return from leave.

7.—Central Provinces Gazette.

21st October 1924.—No. 3983-1877-III.—Mr. G. B. Baksi, Assistant Conservator of Forests, attached to the office of the Conservator of Forests, Northern Circle, Jubbulpore, is transferred to the Betul Forest Division as an attached officer.

No. 3983-A-1877-III.—Mr. K. C. Roy, Assistant Conservator of Forests, attached the office of the Conservator of Forests, Berar Circle, is transferred to the Yeotmal Forest Division as an attached officer to hold charge of a range.

No. 3983-B-1877-III.—Mr. A. H. Stein, Assistant Conservator of Forests, attached to the Saugor Forest Division, is transferred in the same capacity to the Melghat Forest Division.

No. 3983-C-1877 III.—Mr. Lakhpat Rai, Assistant Conservator of Forests, attached to the office of Conservator of Forests, Southern Circle, Nagpur, is posted to he South Chanda Division as an attached officer.

30th October 1924.—No. 4081-2148-III.—Mr. E. L. P. Forter, Assistant Conservator of Forests, attached to the South Chanda Forest Division, is transferred in the same capacity to the Buldana Forest Division.

1st November 1924 —No. 4141-2155-III.—On return from leave, Mr. J. Carr, Deputy Conservator of Forests, Central Provinces, is posted to the Betul Forest Division.

No 4143—2136-III —Under rule 81 of (*b*) (i) of the Fundamental Rnles, leave on average pay for four months is granted to Mr Syed Abdul Vahid, B.A. (Oxon.), B.Sc., Assistant Conservator of Forests, attached to North Chanda Division, with effect from the date on which he may be permitted to avail himself of it.

4th November 1924 —No 4235-1897-III —On return from leave, Mr H. C. Watts, B.A. (Cantab.), Deputy Conservator of Forests, Central Provinces, is posted to the South Raipur Division.

No. 4236-1897-III —On relief by Mr. H. C. Watts, B A. (Cantab.), Deputy Conservator of Forests, Mr. Dhanraj Dutt, Extra Assistant Conservator of Forests is posted as attached officer and Assistant for Working Plans to the South Raipur Division.

8.—Madras Gazette.

2nd October 1924.—M.R.Ry. S. Ramaswami Ayyar Avargal, Extra Assistant Conservator of Forests, on relief by M. R Ry. A. Raju Nayakkar Avargal, to be attached to the Nilambur Division.

9th October 1924 —M.R.Ry. S. Ramaswami Ayyar, Extra Assistant Conservator of Forests, is granted leave on average pay for one month on relief by M.R.Ry A. Raju Nayakkar.

M.R.Ry. M. Srinivasaraghava Acharya, Extra Assistant Conservator of Forests, on relief by Muhammad Abdul Hafiz Sahib Bahadur, to be attached to the East Kurnool Division.

10th October 1924.—M.R.Ry. K. Veeraswami Ayya Avargal, Forest Panchayat Officer is granted leave on average pay for 17 days with effect from 20th October 1924

13th October 1924 —Mr. S. K. Basu, Assistant Conservator of Forests, South Mangalore, is granted leave on average pay for one month and 13 days from 10th November 1924 with permission to affix the ensuing Christmas holidays.

14th October 1924 —No. 299.—Captain H. A. Irwin, M.C., Forest Engineer, is granted privilege leave for two months and 27 days and in continuation thereof furlough on average pay for five months and 3 days with effect from the date of relief.

15th October 1924 —No. 30[illegible].—Mr H. A. Latham, Conservator of Forests, is granted leave on average pay for three months and 28 days and in continuation thereof leave on half average pay for one year, 8 months and 14 days with effect from or after 23rd November 1924.

22nd October 1924 —M.R.Ry. V. Narayana Ayyar Avargal, Extra Assistant Conservator of Forests, on return from leave, is attached to the IV Circle.

M.R Ry. M Srinivasaraghava Acharaya, Extra Assistant Conservator of Forests, will be attached to the West Kurnool Division. This cancels the Notification attaching him to the East Kurnool Division.

9.—Bombay Gazette.

23rd October 1924.—No. S. 20/10/18014.—The Governor, with the concurrence of the Minister, is pleased to make the following appointments :—

Mr H. W. Starte, on return from leave, to be Assistant to the Divisional Forest Officer, Surat.

Mr. W. A. H. Miller, on return from leave, to be Divisional Forest Officer, Poona, pending further orders.

Mr. Madan Lal Khanna, on relief by Mr. W. A. H. Miller, to be Assistant to the Divisional Forest Officer, Poona.

Mr. J. B. T. Brooks, on return from leave, to be Divisional Forest Officer, North Thana.

Mr. G. S. Butterworth, Divisional Forest Officer, North Thana, to be Divisional Forest Officer, E. D. Kanara, *vice* Mr. D. B. Sothers, proceeding on leave.

Mr. F. A. B. Coelho, Assistant to the Divisional Forest Officer, N. D. Kanara, to be Assistant to the Divisional Forest Officer, Kolaba.

Mr. F. M. Kewalramani, Assistant to the Divisional Forest Officer, Kolaba, to be Assistant to the Divisional Forest Officer, N. D. Kanara.

4th November 1924.—No. S. 20/10/18898.—The Governor with the concurrence of the Minister is pleased to make the following appointments:—

Mr. R. F. Sandeman, Assistant Conservator of Forests, to be Divisional Forest Officer, North Thana, pending return of Mr. J. B. T. Brooks from leave.

Mr. E. T. C. Vas, on return from leave, to be Assistant Conservator of Forests in the Northern Circle.

10.—Burma Gazette.

8th October 1924.—No. 234.—Mr. J. D. Hamilton, Deputy Conservator of Forests, has been granted by the High Commissioner for India an extension of leave on medical certificate for three months in continuation of the leave granted to him in this department Notification No. 121, dated the 5th May 1924.

10th October 1924.—No. 235.—On return from leave, Mr. H. W. A. Watson, Conservator of Forests, is appointed to officiate as Chief Conservator of Forests, Burma, in place of Mr. C. B. Smales, officiating Chief Conservator of Forests, proceeding on leave.

No 236.—Under the provisions of rules 80, 81 and 86 of the Fundamental Rules and the orders contained in the Government of India's Finance Department letter No. 2081 C.S.R, dated the 26th November 1923, leave on average pay for eight months and in continuation thereof leave on half average pay for four months and twenty-six days for a total period of one year and twenty-six days, is granted to Mr. C. B. Smales, officiating Chief Conservator of Forests, Burma, with effect from the 20th November 1924 or the subsequent date on which he avails himself of it.

11th October 1924.—No. 237.—Mr. D. H. M. Silvanus, Deputy Conservator of Forests, is permitted by His Majesty's Secretary of State for India to resign the Indian Forest Service, with effect from the 30th June 1924.

No. 238.—On return from leave, Mr. W. C. Rooke, Extra Assistant Conservator of Forests, is posted to duty in the Minbu Forest Division, with headquarters at Minbu.

16th October 1924.—No. 240.—Mr. W. H. Osborne, Assistant Conservator of Forests, attached to the Mu Forest Division, is transferred from Shwebo and placed on special duty at Mandalay in connection with the measurement of timber in the Mandalay Depôt Forest Division.

No. 241.—The services of Mr. J. W. R. Sutherland, Deputy Conservator of Forests, Burma, are placed at the disposal of the University College, Rangoon, for employment as Lecturer in Forestry with effect from the 1st December 1924.

No. 242.—On completion of the special duty to which he was posted in this Department Notification No. 211, dated the 9th September 1924, Mr. T. C. D. Ricketts, Assistant Conservator of Forests, is transferred from Mandalay and reposted to duty in the Working Plans Circle, with headquarters at Maymyo.

No. 243.—On completion of the special duty to which he was posted in this Department Notification No. 212, dated the 9th September 1924, Mr. R. J. Sayres

Assistant Conservator of Forests, is transferred from Mandlay and reposted to duty in the Working Plans Circle, with headquarters at Maymyo.

No. 244.—On completion of the special duty to which he was posted in the Department Notification No. 189, dated the 31st July 1924, Mr. H H. C. Pudden, Assistant Conservator of Forests, is transferred from Pakôkku, and posted to duty in the Tharrawaddy Forest Division.

No. 245.—On completion of the special duty to which he was posted in this Department Notification No. 186, dated the 31st July 1924, Mr P. Meyrick-Jones, Assistant Conservator of Forests, is transferred from Prome and reposted to duty in he Tharrawaddy Forest Division.

No. 246.—On completion of the special duty to which he was posted in this Department Notification No. 185, dated the 31st July 1924, Mr. G. D Warwick, Assistant Conservator of Forests, is transferred from Prome and reposted to duty in the Zigôn Forest Division, with headquarters at Tharrawaddy.

No. 247.—On completion of the special duty to which he was posted in this Department Notification No. 208, dated the 9th September 1924, Mr. D. E. Belford Manning, Assistant Conservator of Forests, is transferred from Pakôkku and posted to duty in the Ataran Forest Division, with headquarters at Moulmein.

No. 248.—On completion of the special duty to which he was posted in this Department Notification No. 187, dated the 31st July 1924, Mr. H. V. Tollemache, Assistant Conse.vator of Forests, is transferred from Mandalay and reposted to duty in the Katha Forest Division.

No. 249.—On completion of the special duty to which he was posted in this Department Notification No. 209, dated the 9th September 1924, Mr. P. N. H. Garnett, Assistant Conservator of Forests, is transferred from Pakôkku and posted to duty in the Pyinmana Forest Division.

22nd October 1924.—No. 251.—On return from leave, U. Han, Extra Assistant Conservator of Forests, is posted to duty in the Bassein Forest Division, as Revenue Assistant.

No. 252.—On relief by U. Han, Extra Assistant Conservator of Forests, Mr. D. W. D'Silva, Extra Assistant Conservator of Forests, attached to the Bassein Forest Division, is transferred from Bassein and is appointed to be Instructor (Major), Burma Forest School, Pyinmana.

No. 253.—Mr. C. W. Scott, Deputy Conservator of Forests and Director, Burma Forest School, is transferred from Pyinmana and posted to duty in the Working Plan Circle, headquatrers at Tavoy.

No. 254.—Mr. A. H. Lloyd, Deputy Conservator of Forests and Instructor (Major) Burma Forest School, is appointed to be Director of the School in place of Mr. C. W. Scott, Deputy Conservator of Forests, transferred.

No. 255.—On completion of the special duty to which he was posted in this Department Notification No. 210, dated the 9th September 1924, Mr. A. N. Barker, Assistant Conservator of Forests, is transferred from Mandalay and reposted to duty in the Working Plans Circle, with headquarters at Maymyo.

27th October 1924.—No. 256.—Under the provisions of Rule 80 and 81 of the Fundamental Rules and the orders contained in paragraph 20, clause (*c*), of Financial Department Notification No. 52, dated the 4th July 1922, leave on average pay for two months and two days and in continuation thereof leave on half average pay for one month and ten days, for a total period of three months and twelve days, is granted to Mr. T. I. Pocock, Extra Deputy Conservator of Forests, with effect from the afternoon of the 13th October 1924.

Mr. Pocock is permitted to retire from the service of Government on the expiry of this leave.

28th October 1924.—No. 257.—Under the provisions of Rules 80 and 81 of the Fundamental Rules, leave on average pay for fifteen days is granted to Mr. R. J. Sayres, Assistant Conservator of Forests, attached to the Working Plans Circle at Maymyo, with effect from the 1st November 1924, or the subsequent date on which he avail himse f of it.

29th October 1924.—No. 258.—Under the provisions of Rules 80 and 81 of the Fundamental Rules, leave on average pay for four months and eighteen days is granted to Mr. R. L. Pocock, Deputy Conservator of Forests in charge of the Minbu Forest Division, with effect from the 5th December 1924, or the subsequent date on which he avails himself of it.

Mr. Pocock is permitted to retire on expiry of the leave.

No. 259.—On return from leave, Mr. W. C. Rooke, Extra Assistant Conservator of Forests, is posted to the charge of the South Pegu Forest Division, in place of Mr. A. R. Villar, Deputy Conservator of Forests, transferred.

This Department Notification No. 238, dated the 11th October 1924, posting Mr. Rooke to duty in the Minbu Forest Division, is hereby cancelled.

No. 260.—On relief by Mr. W. C. Rooke, Extra Assistant Conservator of Forests, Mr. A R. Villar, Deputy Conservator of Forests, is transferred from Pegu to Mandalay and placed on special duty in connection with the measurement of timber in the Mandalay Depôt Forest Division.

No. 261.—On completion of the special duty to which he was posted in this Department Notification No. 189, dated the 31st July 1924, Mr. H. H. C. Pudden, Assistant Conservator of Forests, is transferred from Pakôkku and posted to duty in the Working Plans Circle, with headquarters at Tavoy.

This Department Notification No. 244, dated the 16th October 1924, posting Mr. Pudden, Assistant Conservator of Forests, to duty in the Tharrawaddy Forest Division, is hereby cancelled.

No. 262.—On return from leave, Mr. J. B. Mercer-Adam, Deputy Conservator of Forests, is posted to the charge of the South Tenasserim Forest Division, in place of Mr. G. F. Matthews, Extra Assistant Conservator of Forests, transferred.

No. 263.—Mr. G. F. Matthews, Extra Assistant Conservator of Fosests, in charge of South Tenasserim Forest Division, is transferred from Tavoy and posted to duty in the North Pegu Forest Division, as Revenue Assistant, with headquarters at Nyaunglebin, in place of Mr. J. M. Campbell, Extra Assistant Conservator of Forests.

No. 265.—Mr. W S. Powell, Deputy Conservator of Forests, is permitted to return to duty before the expiry of the leave granted to him in this Department Notification No. 82, dated the 3rd April 1923, and is posted to the charge of the Pyinmana Forest Division, in place of Mr. R. W. V. Palmer, Deputy Conservator of Forests, transferred.

No. 266.—Mr. R. W. V. Palmer, Deputy Conservator of Forests, in charge of the Pyinmana Forest Division, is transferred from Pyinmana and placed on special duty at Mandalay in connection with the measurement of timber in the Mandalay Depôt Forest Division.

LIST OF BOOKS AND PUBLICATIONS RECEIVED BY THE HONORARY EDITOR DURING THE MONTHS OF OCTOBER-NOVEMBER 1924.

Indian Engineering, Vol. LXXVI, Nos. 16, 17, 18 and 19, dated 18th and 25th October and 1st and 8th November 1924.

The Timber Trades Journal, Vol. XCVI, Nos. 2509, 2510, 2511 and 2512, dated 27th September, and 4th, 11th and 18th October 1924.

Experiment Station Record, Vol. 49, Index Number, issued 9th August 1924, and Vol. 51, No. 2, August 1924, and No. 3, Abstract Number, issued 2nd September 1924.

The Review of Applied Entomology, Series A: Agricultural, and Series B: Medical and Veterinary, Vol. XII, Part 9, September 1924.

The Scottish Geographical Magazine, Vol. XL, No. 5, dated 15th September 1924.

Proceedings of the Legislative Council of the Governor of Madras, Vol. XIX, Nos. 4, 5, and 6, dated 21st, 22nd and 23rd August 1924 and Index, November 1923 to April 1924, Vol. XV, XVI, XVII, and XVIII.

The Makiling Echo, Vol. III, No. 3, August 1924.

Annual Report of the Director of Agriculture, Cyprus, for the year 1923.

Administration Report of Trinidad and Tobago for the year 1923.

C. Leary & Co.'s London Market Reports, 1st to 30th September 1924.

The Madras Forest College Magazine, Vol. IX, No. 1, September 1924.

The Fauna of British India including Ceylon and Burma—Birds, Vol. II, (Second edition), by E. C. Stuart Baker, O.B.E., F.Z.S., etc.

The Australian Forestry Journal, Vol. VII, No. 8, August 1924.

International Review of the Science and Practice of Agriculture, New Series, Vol. II, No. 2, April—June 1924.

Annual Report of the Director of Forestry, New Zealand, State Forest Service, for the year ended 31st March 1924.

No. 5—Papers on Indian Tabanidæ; No. 6—Two Drosophilidæ from Coimbatore; No. 7—A New Aphidiphagous Fly; No. 8—Notes on Indian Odonata in the Pusa Collection and No. 9—On New and Old Oriental Cicindelaidæ—Memoirs of the Department of Agriculture in India, Entomlogical Series, Vol. VIII, Nos. 5, 6, 7, 8 and 9, August 1924.

Journal of Fotestry, Vol. XXII, No. 6, October 1924.

The Forest Flora of New South Wales, Vol. VIII, Part 7 (Part LXXVII of the Complete Work).

Annual Report of the Forest Department, Colony and Protectorate of Kenya, 1923.

Annual Return of Statistics relating to Forest Administration in British India for the year 1922-23.

Report of Forest Administration in Baluchistan for 1922-23.

Industrial India, Special Agricultural Number, Vol. IV, No. 2, September 1924.

Revue des Eaux et Forests, Vol. LXII, No. 10, October 1924.

The Tropical Agriculturist, Vol. LXIII, No. 4, October 1914.

The cost of producing market milk and butter fat on 246 California Dairies—Agricultural Experiment Station, Berkeley, California, Bulletin No. 372 of November 1923.

A survey of orchard practices in the Citrus Industry of Southern California—Agricultural Experiment Station, Berkeley, California, Bulletin No. 374 of January 1924.

Results of rice experiments at Cortena, 1923, and progress in experiments in water grass control at the Biggs Rice-field Station, 1922-23—Agricultural Experiment Station, Berkeley, California, Bulletin No. 375 of February 1924.

Sun-drying and dehydration of Walnut—Agricultural Experiment Station, Berkeley, California, Bulletin No. 376 of March 1924.

California Farm Tenancy and methods of leasing—Agricultural Experiment Station, Berkeley, California, Circular No. 272, November 1923.

Saving the Gopherd Citrus Tree—Agricutural Experiment Station, Berkeley, California Circular No. 273, December 1923.

Fusarium Wilt of Tomato and its control by means of resistant varieties—Agricultural Experiment Station, Berkeley, California, Circular No. 274, January 1924.

Marketable California decorative greens—Agricultural Experiment Station, Berkeley, California, Circular No. 275, February 1924.

Some mutual effects on Soil and Plant induced by added Solutes—Agricultural Experiment Station, Berkeley, Technical Paper No. 13, December 1923.

Allahabad :—Printed and published at the Pioneer Press, by C. G. HARRIS,
No. 1624—1-12-24

QUOTATIONS FOR TIMBER.

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date	Per	Prices.
1	2	3	4	5	6	7	8	9
1	*Ainee* ...	*Artocarpus hirsuta*	Logs ...	Kallai, S. I.	The Managing Agents, New Malabar Timber Yards & Saw Mills, Ltd., Kallai, S. I.	Jany. 1924	c.ft. ...	Rs. 1-8 to Rs. 2
2	,, ...	,, ...	Scantlings ..	,, ...	Do. ...	,, ..	,, ...	3-8 to 4-8
3	*Amb* ...	*Mangifera indica* ..	Logs ...	Quilon, S. I.	Harrison & Crosfield Ltd, Quilon.	Novr. 1923	,, ...	0-10
4	,, ..	,, ...	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	1-2
5	,, ...	,, ...	Planks ...	,, ...	Do. ...	,, ...	,, ...	1-5
6	,, ...	,, ...	Logs ...	Itarsi, G. I.P. Ry.	Shiam Lall, Contractor.	Septr. 1923	,, ...	0-6
7	*Asna* ...	*Terminalia tomentosa.*	,, ..	,, ..	Do. ..	Octr. 1923	,, ...	1-12 to 2-4
8	,, ...	,, ...	Scantlings ..	Clutterbuckganj (O. & R.)	Conservator of Forests, Utilisation Circle, Bareilly.	,, ...	sleeper	1-12 to 2
9	,, ..	,, ...	M. G. Sleepers 6′ × 8″ × 4½″.	,, ...	Do. ...	,, ...	,,	2-4

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices.
1	2	3	4	5	6	7	8	9
								Rs. Rs.
10	*Asna* ...	*Terminalia tomentosa.*	Unsawn logs ...	Pollachi, South Indian Railway.	District Forest Officer, South Coimbatore.	Novr. 1923	c.ft. ...	0-14 to 1-2
11	,, ...	,, ...	Round logs ...	Ballarshah Depôt, G. I. P. Ry.	Divisional Forest Officer, South Chanda, C. P.	Decr. 1923	,, ..	1-2 to 1-4
12	,, ...	,, ...	Rough squared logs	,, ...	Do. ...	,, ...	,, ...	1-4 to 1-6
13	,, ...	,, ...	Logs ...	Quilon, S. I.	See 3 ...	Novr. 1923	,, .	1-8
14	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	3-10
15	,, ...	,, ...	Planks ...	,, ...	Do. ...	,, ...	,, ...	4
16	,, ...	,, ...	Logs ...	Mangalore & Kasargod, S. I. Ry.	Divisional Forest Officer, South Mangalore.	,, ...	,, ...	1-3 to 1-8
17	,, ...	,, ...	Sawn scantlings ...	,, ...	Do. ...	,, ...	,, ...	2-4
18	,, ...	,, ...	Round Logs ...	Nagpur ...	G. B. Titi, Esq., Post Box No 900, Bombay.	,, ...	ton. ...	60
19	,, ...	,, ...	,, ...	Godhra ...	Do. ..	,, ...	,, ...	40
20	,, ...	,, ...	,, ...	Udaipur ...	Do. ...	,, ...	,, ...	40
21	,, ...	,, ...	Hewn squared logs.	Nagpur ...	Do. ...	,, ...	,, ...	70

22	,, ...	,, ...	,, ...	Godhra .	Do. ...	,, ..	,, ...	45		
23	,, ...	,, ...	,, ...	Udaipur ...	Do ...	,, ...	,, ...	50		
24	,, ...	,, ...	B G. Sleepers 9′ × 16″ × 5″	Nagpur or Bilaspur.	Do. ..	,, ...	each ...	5		
25	,, ...	,, ...	M. G. 6′ × 8″ × 4½″	Bilaspur ...	Do. ...	,, ..	,, ...	2-2		
26	,, ...	,,	N. G. ...	Godhra or C. Udaipur.	Do. ..	,, ...	,, ..	1-8		
27	,, ...	,, ..	Sawn squared ...	Jharsuguda	Do. ...	,, ...	ton ..	65		
28	,, ..	,,	,, ...	C. Udaipur	Do. ...	,, ...	,, ..	55		
29	,, ...	,, ...	Sawn scantlings ...	F. O. R. Bombay.	Do. ...	,, ..	c.ft. ...	2		
30	*Badam* ...	*Terminalia procera*	Squares ...	Calcutta ...	Martin & Co., Calcutta.	Jany. 1924	ton ...	70		
31	,, ...	,, ...	Scantling ..	.. ...	Do. ...	,, ...	,, ...	80	to	120
32	*Bahan* ...	*Populus euphratica*	Billets 3′ long and above 3′ in girth.	Ghazi g h at, N.-W. Ry.	Divisional Forest Officer, Multan, Punjab.	March 1923	c.ft ..	0-8		
33	*Babul* ...	*Acacia arabica* ...	Firewood ...	Poona ...	S. G. Patankar, Secretary, Forest Merchant's Association, Poona City.	Novr. 1923	khandi	9	to	10
34	,, ...	,,	Logs ...	C h a n g a Manga.	Divisional Forest Officer, Northern Plantation Division, Lahore.	,, ..	c.ft. ...	0-10		
35	*Bakain* ...	*Melia Azedirach*	,, ...	,, ...	Do. ..	,, ...	,, ...	1-5-3		
36	*Baing* ..	*Tetrameles nudiflora*	,, ...	Kallai, S. I	See 1 ...	Jany. 1924	,. ...	0-9	to	0-12
37	,, ...	,, .	Scantlings ...	,, ...	Do. ...	,, ...	,. ...	1-8	to	2
38	*Beembo* ...	*Adina cordifolia*	See aldu.							
39	Benteak ..	*Lagerstræmia microcarpa.*	Logs ...	Mang a l o r e & Kasargod.	See 16 ...	Novr. 1923	,, ...	0-14	to	1-4
40	,, ..	,, ...	Sawn scantlings ...	,, ..	Do. ...	,, ...	,, ...	2		
41	,, ...	,, ...	,, ...	Kallai, S. I.	See 1 ...	Jany. 1924	,, ...	3-8	to	4
42	,, ...	,, ...	Logs ...	,, ..	Do. ..	,, ...	,, ...	1-4	to	1-8

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices.
1	2	3	4	5	6	7	8	9
43	*Bija* ..	*Pterocarpus Marsupium.*	Round logs ...	Ballarshah Depôt, G. I. P. Ry.	See 11 ...	Decr. 1923	c.ft. ...	Rs. 1-3 to Rs. 1-4
44	,, ...	,, ...	Rough squared logs.	,, ...	Do. ...	,, ...	,, ...	1-4 to 1-6
45	,, ...	,, ...	Logs ...	Itarsi ...	See 6 ...	Septr. 1923	,, ...	0-12
46	,, ...	,, ...	Logs ...	F. O. R., G. I. P. & B. N. Ry. Stations.	See 18 ...	Novr. 1923	,, ...	1-8
47	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	2-4
48	,, ...	,, ...	,, ...	Godhra ...	Do. ...	,, ...	,, ...	1-8 to 3
49	Blackwood	*Dalbergia latifolia*	Logs ...	Kallai, S. I.	See 1 ...	Jany. 1924	,, ...	4 to 7
50	,, ...	,, ...	,,	Mangalore & Kasargod.	See 16 ...	Novr. 1923	,, ...	2 to 2-8
51	Black Dammar.	*Dipterocarpus indicus.*	Logs ...	Kallai, S. I.	See 1	Jany. 1924	,, ...	1-4 to 1-8
52	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	3-4 to 3-8
53	Blue Pine	*Pinus excelsa* ...	,, ...	Jhelum ...	Divisional Forest Officer, Jhelum.	Novr. 1923	,, ...	0-14 to 1-8
54	Cedar Red	*Cedrela Toona* ...	Logs ...	Kallai, S. I.	See 1 ...	Jany. 1924	,, ...	1-8 to 1-12
55	,, ...	,, ...	Sleepers 4′×10″×5″ to 12′×12″×6″.	Clutterbuckganj (O. & R.)	See 8 ...	,, ...	,, ...	1-6

56	*Chil* or *Chir*	*Pinus longifolia* ...	Sleepers 12′ ...	Lalta Rao Depôt.	Depôt Forest Officer, Lalta Rao Depôt, Hardwar, U. P.	July 1923 ...	score ...	No quotations.
57	,, ...	,, ...	,, ...	Jagadhri ...	E. A. C. River Sub-Division, Kalsi P. O., District Dehra Dun.	Jany. 1924	piece ...	3 to 4
58	,, ...	,, ...	,, 10′ ...	,, ...	Do. ...	,, ...	,, ...	2-4
59	,, ...	,,	,, 8′ ...	,, ...	Do. ...	,, ...	,, ...	1-8 to 2-8
60	,, ...	,, ...	,, 6′ ...	,, ...	Do. ...	,, ...	,, ...	0-14
61	,, ...	,, ...	,, 12′ × 10″ × 5″ (2nd quality).	Clutterbuckganj (O. & R.).	See 8 ...	Octr. 1923	,, ..	3-4
62	,, ..	,, ...	Squares and Scantlings 6′ × 6″ × 6″ to 12′ × 10″ × 10″	,, ...	Do. ...	,, ...	c.ft. ...	0-14
63	,, ..	,, ..	Sleepers ...	Jhelum ...	See 53 ...	Decr. 1923	,, ...	0-8 to 0-15-3
64	,, ..	,, ...	Sleepers 12′ × 10″ × 5″.	Hardwar ..	Ganga Ram & Sons, Timber Merchants, Hardwar.	Octr. 1923	piece ...	2-12 to 4
65	,, ...	,, ..	Karries ...	Dilwan ..	Divisional Forest Officer, Depôt, East Division, Phillaur.	Novr. 1923	c.ft. ..	0-6-11
66	,, ...	,, ...	Sleepers	,, ...	Do. ...	,, ...	,, ...	0-7 to 0-11-4
67	*Chir* ...	,, ...	Sleepers 12′ × 10″ × 5″ (1st quality).	Clutterbuckganj (O. & R. Ry.).	Salamat Singh & Mukand Pershad, Contractors.	,, ...	piece ..	3-14
68	,, ...	,, ...	,, (2nd quality).	,, ...	Do. ...	,, ...	,, ...	3-4
69	*Chorpayan*	*Hardwickia pinnata*	Logs ...	Kallai, S. I.	See 1 ...	Jany. 1924	c.ft. ...	1 to 1-8
70	,, ...	,, ...	Scantlings ..	,, ...	Do. ...	,, ...	,, ...	3 to 3-8
71	Deodar ..	*Cedrus Deodara* ..	Sleepers 6′ to 12′...	Jagadhri ...	See 57 ...	,, ...	piece ...	2-8 to 8
72	,, ..	,, ...	,, 8′ × 10″ × 5″.	Hardwar ...	See 64 ...	Novr. 1923	,, ...	4-8
73	,, ..	,, ..	,, 10′ × 10″ × 5″	,,	Do. ...	,, ...	,, ...	150

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices.
1	2	3	4	5	6	7	8	9
								Rs. Rs.
74	Deodar ...	*Cedrus Deodara* ...	Ballies 12′ ...	Dhilwan ..	See 65 ..	Novr. 1923	c.ft. ...	0-7-6
75	,, ...	,, ..	Sleepers ..	,, ...	Do. ...	,, ...	,, ...	0-8 to 1-8
76	,, ...	,, ..	Gattus ...	,, ...	Do. ...	,, ...	,, ...	0-12
77	,, ...	,, .	Karries ...	,, ..	Do ...	,, ..	,, ...	0-14-9
78	,,	,, ...	Sleepers ...	Jhelum ...	See 53 ...	Decr. 1923	,, ..	0-11-6 to 2-5-0
79	,,	,, ...	Gattus ...	,, ...	Do. ...	,, ...	,, ...	1-10 to 2
80	,,	,, ...	Logs ...	,, ...	Do. ...	,, .	,, ...	1-2 to 1-12
81	,,	,, ...	Logs II A class ...	Jhelum ...	Divisional Forest Officer, Lower Jhelum Division (Kashmir State), Jhelum.	*Octr. 1923	,, ...	1-6-11
82	,,	,, ..	Logs II B class ...	,, ...	Do. ...	,, ...	,, .	1-0-9
83	,,	,, ...	B. G sleepers I ...	,, ...	Do ..	,, ...	each ...	6-12-9
84	,,	,, ...	,, II ..	,, ...	Do. ...	,, ...	,, .	3-13-6
85	,,	,, ...	Sleepers 8′—I ...	,, ...	Do ...	,, ...	,, ...	4-3
86	,,	,, ...	,, 8′—II ...	,,	Do ...	,, ...	,, ...	2-11-6
87	,,	,, ...	Balas ...	,, ...	Do. ...	,, ...	,, ...	1-10
88	*Dhup* ...	*Canarium euphyllum*	Scantlings ..	Calcutta ...	See 30 ..	Jany. 1924	ton ...	77-8 to 112-8
89	*Dhupa* ...	*Vateria indica* ...	Logs ...	Kallai, S. I.	See 1 ...	,, ...	c ft ...	1 to 1·4
90	*Didu* ...	*Bombax insigne* ...	Scantlings ...	Calcutta ...	See 30 ...	,, ...	ton ...	75 to 105
91	Fir ...	*Abies Pindrow* ...	,, ...	Jagadhri, N.-W. Ry. and Clutterbuckganj (O. & R.).	See 8 ...	...	,, ...	42 to 45

* Auction held on 23rd and 24th October 1923.

92	,, ...	,, ...	Sleepers 12′ × 10″ × 5″.	Jagadhri, N.-W. Ry.	Do.	...	Novr. 1923	score ...	60	
93	,, ...	,, ...	Beams 17′—I ...	Jhelum ...	See 81	...	Octr. 1923...	each ...	8-1-6	Auction held on 23rd and 24th October 1923.
94	,, ...	,, ...	,, 17′—II ...	,, ...		...	,, ...	,, ...	6 1-7	
95	,, ...	,, ...	,, 15′—I ...	,, ...		...	,, ...	,, ..	7-5-3	
96	,, ...	,, ...	,, 15′—II ...	,,		...	,, ..	,, ..	4-2-9	
97	,, ...	,, ...	,, 12′—I ...	,, ...		...	,, ...	,, ..	4-2	
98	,, ...	,, ...	B. G. sleepers ...	,, ...		...	,, ...	,, .	1-5-8	
99	,, ...	,, ...	Sleepers ...	Dilwan ..	See 65	...	Novr. 1923	c.ft. ...	0-5-7	to 0-7-1
100	,, ...	,, ...	Gattus ...	,, ...	Do.	...	,, ...	,, ...	0-6	
101	,, ...	,, ...	Karries ...	,, ...	Do.	..	,, ..	,, .	0-7-9	
102	,, ...	,, ...	Scantlings ...	Jhelum ..	See 53	...	,, ...	,, ...	0-7	to 0-15
103	,, ...	,, ...	Sleepers pieces ...	,, ...	Do.	...	,, ...	,, ..	0-2	
104	*Gumhar* ..	*Gmelina arborea.*	Logs Round ...	Ballarshah	See 11	...	Decr. 1923	,, ...	1-3	to 1-9
105	,, ...	,, ...	,, ..	,, ...	Do.	..	,, ..	,,	1-9	to 1-12
106	*Gurjan* ... (Andaman)	*Dipterocarpus turbinatus.*	Squares ...	Calcutta ...	See 30	...	Jany. 1924	ton	90	
107	,, ...	,, ...	Scantlings	,, ...	Do.	...	,, ..	,, ...	100	to 150
108	*Gurjan* .. (Burma).	,, ..	Logs ...	,, ...	Do.	...	,, ...	,, ...	80	
109	*Haldu* ...	*Adina Cordifolia* ...	Logs ...	G. I. P., B. N. R. and B. B. & C. I. Stations.	See 18	..	,, ...	c.ft. ...	0-8	to 1-4
110	,, ..	,, ...	Round logs ...	Ballarshah Depôt, G. I. P. Ry.	See 11	...	Decr. 1923	,, ...	1-2	to 1-8
111	,, ...	,, ...	Rough squared logs	,, ...	Do.	...	,, ..	,, ...	1-4	to 1-9
112	,, ...	,, ...	Scantlings ...	Kallai, S. I.	See 1	...	,, ...	,, .	2	
113	*Honne* ...	*Pterocarpus Marsupium.*	See *bija.*							
114	*Irool* ...	*Xylia xylocarpa* ...	Logs ...	Kallai, S.I.	Do.	...	Jany. 1924	c.ft .	1-4	to 1-8
115	,, ...	,, ..	,, ...	Mangalore & Kasargod.	See 16	...	Decr. 1923	,, ...	1-8	
116	,, ...	,, ...	Sawn scantlings ...	,, ...	Do.	...	,, ...	,, ...	2-4	
117	.. ...	,, ...	Logs .	,, ...	Do.	...	,, ..	,, ..	1-8	
118	Jackwood...	*Artocarpus integrifolia.*	,, ...	Kallai, S. I.	See 1	...	Jany. 1924	,, ...	1-8	to 2

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices	
1	2	3	4	5	6	7	8	9	
								Rs.	Rs.
119	Jackwood...	*Artocarpus integrifolia.*	Scantlings ...	Kallai S. I.	See 1 ...	Jany. 1924	c.ft. ...	3-8	to 4-8
120	*Kail* ...	*Pinus excelsa* ...	Sleepers 12′ ...	Jagadhri ...	See 57 ..	,, ...	piece ...	4	
121	,, ...	,, ...	,, 10′ ...	,, ...	Do. ...	,, ...	,, ...	3-4	
122	,, ...	,, ...	,, 8′ ...	,, ...	Do. ...	,, ...	,, ...	2-8	to 4
123	,, ...	,, ...	,, 6′ ...	,, ...	Do. ..	,, ...	,, ..	1-2	
124	,, ...	,, ...	Sleeper pieces 8′×12′×6″.	Hardwar ...	See 64 ...	Novr. 1923	,, ...	4-12	
125	,, ...	,, ...	Ballas above 24″ in girth.	Dhilwan ...	See 65 ...	,, ...	c.ft. ...	0-3-6	
126	,, ...	,, ...	Ballies ...	,, ...	Do. ...	,, ...	,, ..	0-7-4	
127	,, ...	,, ...	Beams ...	,, ...	Do. ...	,, ...	,, ...	0-13-4	
128	,, ...	,, ...	Sleepers ...	,, ..	Do. ...	,, ..	,, ...	0-11	to 1-0-6
129	,, ...	,, ...	Gattus ...	,, ...	Do. ...	,, ...	,, ...	0-6	to 1-5-3
130	,, ...	,, ...	Karries ...	,, ...	Do. ...	,, ...	,, ...	0-12-6	
131	,, ...	,, ...	Logs III C. Class...	Jhelum ...	See 81 ..	Octr. 1923 ..	,, ...	0-2-8	
132	,, ...	,, ...	Beams 17′—I ...	,, ..	...	,, ...	each ...	14	Auction held on 23rd and 24th Octr. 1923.
133	,, ...	,, ...	,, 17′—II ..	,, ...	...	,, ...	,, ...	10	
134	,, ...	,, ...	,, 15′—I ...	,,	...	,, ...	,, ...	13-6	
135	,, ...	,, ...	,, 15′—II	,, ...	...	,, ..	,, ...	8-5	
136	,, ...	,, ...	,, 12′—I ...	,, ...	...	,, ...	,, ..	9-0-11	
137	,, ...	,, ..	,, 12′—II ...	,, ...	...	,, ...	,, ...	5-2-0	
138	,, ...	,, ...	B. G. sleepers I ...	,, ...	...	,, ...	,, .	2-12-10	
139	,, ...	,,	,, II ..	,, ...	...	,, ..	,, ...	1-13-4	
140	,, ...	,, ...	Sleepers 8′—I ...	,, ...	...	,, ...	,, ...	2 7-3	
141	,, ...	,, ...	,, 8′—II ...	,, ...	...	,, ...	,, ...	1-11-6	
142	,, ...	,, ...	,, 6′—I ...	,, ...	...	,, ...	,, ...	1-0-3	
143	,, ...	,, ...	Ballas ...	,,	...	,, ...	,, ...	1-1 0	
144	,, ...	,, ...	Pieces of all sizes	,, ...	...	,, ...	,, ...	0-8-6	

145	*Kalpaini* ...	*Dipterocarpus indicus.*	See black dammar.							
146	*Kanyin* ...	*Dipterocarpus turbinatus.*	See *gurjan.*							
147	*Karmaraḍu*	*Terminalia tomentosa.*	See *Asan.*							
148	*Kindal* ...	*Terminalia paniculata.*	Logs ...	Kallai, S. I.	See 1 ...	Jany.	1924	each ...	1-4	to 1-8
149	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,,	...	,, ...	3-8	to 3-12
150	,, ...	,, ...	Sawn Scantlings ...	Mangalore, S. I.	See 16 ...	Decr.	1923	c.ft ...	1-14	
151	,, ...	,, ...	Logs ...	,, ...	Do. ...	,,	...	,, ...	0-1	to 1-2
152	,, ...	,, ...	Unsawn logs ...	Pollachi, South Indian Ry.	See 10 ...	,,	...	,, ...	0-13	to 1
153	,, ...	,, ...	Sawn Logs ..	,, ...	Do. ...	,,	..	,, ..	1-4	to 1-12
154	,, ...	,, .	Logs ...	Quilon, S. I.	See 3 ...	Decr.	1923	,, ..	1-2	
155	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,,		,, ...	2-10	
156	,, ...	,, ...	Planks ...	,, ...	Do. ...	,,	...	,, ...	3	
157	*Kiralbogi*	*Hopea parviflora*	Logs ...	Mangalore & Kasargod, S.I. Ry.	See 16 ..	Novr.	1923	,, ..	1	to 2
158	.. ...	,, ...	Sawn scantlings ...	,, ...	Do. ...	,,	...	,, ...	2-12	
159	Koko ...	*Albizzia Lebbek* ...	Scantling ..	Calcutta ...	See 30 ...	Jany.	1924	ton ...	90	to 150
160	*Kottkannabagi.*	*Albizzia spp.* ...	Logs ...	Mangalore & Kasargod.	Do. ...	,,	...	c.ft. ...	1	
161	,, ...	,, ...	Sawn scantlings ..	,, ...	Do. ...	,,	..	,, ...	1-12	
162	*Letpan* ...	*Bombax malabaricum.*	Logs ...	Kallai, S. I.	See 1 ...	,,	...	,, ...	0-9	to 0-12
163	,, ...	,, ...	Scantlings ...	,, ...	Do ...	,,	...	,, ...	1-8	to 2
164	Mango ...	*Mangifera indica* ..	See *amb.*							
165	*Matti* ...	*Terminalia tomentosa.*	See *asan.*							
166	Mulberry ...	*Morus indica* ...	Logs ...	Changa Manga.	See 34 ...	Decr.	1923	,, ...	0-12	to 3-13-4
167	,, ...	,, ..	Selected Fuel ...	,, ...	Do. ...	,,	...	% c.ft.	24-12-3	

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices
1	2	3	4	5	6	7	8	9
								Rs. Rs.
168	Mulberry ...	*Morus indica* ...	Ordinary Fuel ...	Changa Manga	See 34 ...	Decr. 1923	% c.ft	12
			Billets ...	,, ...	Do. ..	,, ...	c.ft. ...	0-13 to 1-0-
169	*Nangal* or *Nahor.*	*Mesua ferrea* ...	Logs ...	Kallai, S. I.	See 1 ...	Jany. 1924	,, ...	2 to 2-4
170	Oak ...	*Quercus spp.* ...	Billets ...	Kathgodam (R. & K. Railway).	See 8 ...	Octr. 1923	ton ...	75
171	Padauk (Andamans).	*Pterocarpus dalbergioides.*	Squares ...	Calcutta ...	See 30 ..	Jany. 1924	,, ...	187-8
172	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,, ..	,, ...	150 to 300
173	Padauk (Burma).	*Pterocarpus Macrocarpus.*	Squares ...	,, ...	Do. ..	,, ..	,, ..	175
174	*Pali* ...	*Dichopsis elliptica*	Logs ...	Kallai, S. I.	See 1 ...	,, ..	,, ..	1-4 to 1-8
175	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	3 to 3-8
176	*Pani* ..	*Vateria indica* ...	See *dhupa.*					
177	*Papita* ...	*Sterculia campanulata.*	Scantling ...	Calcutta ..	See 30 ..	Jany. 1924	ton ..	72-8 to 102-8
178	*Payin* ..	*Vateria indica* ...	See *dhupa.*					
179	*Pilamaruda*	*Terminalia paniculata.*	See *kindal.*					
180	*Poon* ...	*Calophyllum tomentosum.*	Logs ...	Kallai, S. I.	See 1 ...	Jany. 1924	c.ft. ..	1-4 to 1-8
181	.. ...	,, ...	Scantlings ...	,, ...	Do.	,, ..	,, ...	3 to 3-8
182	*Pula* ...	*Bombax malabaricum.*	See *letpan.* ..					

183	,, ...	,, ...	Logs ..	Calcutta ..	See 30 ...	Jany. 1924	ton ..	100	
184	*Pyinma* (Andaman	*Lagerstræmia hypoleuca.*	Squares ...	,, ...	Do. ...	,, ...	,, ...	1.0	
185	,, ...	,, ...	Squares (selected	,, ..	Do ...	,, ...	,, ...	125	
186	,, ...	,, ...	Scantlings ..	,, ...	Do ...	,, ...	,, ...	100 to 150	
187	*Redpayan*	*Hardwickia pinnata.*	See *chorapayan.*						
188	Rosewood...	*Dalbergia latifolia*	See "Blackwood."						
189	*Saïn* ...	*Terminalia tomentosa.*	See *asan.*						
190	*Saj* ...	*Terminalia tomentosa.*	,,						
191	*Sal* ...	*Shorea robusta*	Logs ..	Sapatagrani	Divisional Forest Officer, Goalpara Division, Assam	Jany. 1924	c.ft	1-4 to 1-9	
192	,, ..		B. G. Sleepers ...	Dhamtari, C. P.	Divisional Forest Officer, South Raipur Division, Raipur, C. P.	Novr. 1923	each ...	4 to 6	
193	,, ...	,, ...	M. G. ,,	,, ...	Do.	,,	,, ...	1-8 to 2	
194	,, ...	,, ...	N. G. ,, ..	,, ...	Do.	,,	,, ...	1 to 1-4	
195	,, ...	.. ..	M. G. Sleepers 6′×8″×4½″ (2nd quality)	Clutterbuckgunj (O. & R. Ry.	Divisional Forest Officer, Dehra Dun.	,,	piece ...	2	
196	,, ...	,,	B. G. Sleepers ...	Kusmi, B. N. W. Ry.	Indian Products Association, Gorakhpur.	June 1923	ton ...	160	
197	,, ...	,, ...	M. G. ,, ...	,, ..	Do. ..	,, ...	,, ...	50	
198	,, ...	,, ...	N. G. ,, ...	.. ...	Do. ...	March 1923	score ...	35	
199	,, ..	.. ...	Scantlings ...	,, ...	Do.	,, ...	ton ..	150 to 175	
200	,, ...	,, ..	Sal Planks ...	,, ..	Do. ..	,, ...	,, ...	175	
201	,, ..	...	Crossing Sleepers 12′×10′×5′.	Haldwani ...	See 8 ...	Novr. 1923	piece...	13	
202	,, ...	..	B. G. Sleepers 9′×10″×5″.	Western Circle Division (O. R. and R. K. Railways).	Do. ..	...	,, ...	8-12	

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices.
1	2	3	4	5	6	7	8	9
								Rs. Rs.
203	*Sai* ...	*Shorea robusta* ...	M. G. Sleepers ...	Western Circle Division (O. K. and R K. Rys).	See 8 ...	...	piece ...	3-5
204	,, ...	,, ...	Logs ...	Calcutta ...	See 30 ...	Jany. 1924	c.ft. ...	2-5 to 3-1
205	,, ...	,, ...	Machine sawn Scantlings 6′ 0″ and up.	Berhampore Ganjam, B. N. Ry.	The Agent, Government Sawmills, Russellkonda, Ganjam.	Septr. 1923	,, ...	2-14-6 to 3-4
206	,, ...	,, ...	Beams ...	,, ...	Do. ..	,, ...	,, ...	3-4 to 4
207	,, ..	,, ...	Logs ..	Bilaspur ...	See 18 ...	Novr. 1923	,, ...	1-4
208	,, ...	,, ...	Scantlings ...	Nagpur ...	Do. ...	,, ...	,, ...	1-8 to 4
209	,, ..	,, ...	Sawn squares ...	,, ...	Do. ..	,, ...	,, ...	2 to 3
210	,, ..	,, ...	B. G. Sleepers ...	Buxa Duar (nearest Ry. station Buxa Road.)	Divisional Forest Officer, Buxa Division (Bengal).	1923-24 ...	piece ..	8
211	,, ...	,, ..	M. G. ,, ...	,, ...	Do. ...	,, ...	,, ...	3-4
212	,, ...	,, ...	Sleepers specials ...	,, ...	Do. ...	,,	c.ft. ...	3-2 to 3-8
213	,, ...	,, ...	Poles 7″ to 12″ diamater.	Sonua ...	Divisional Forest Officer, Singhbhum Division, Chaibassa.	Novr. 1923	piece ...	1-4 to 4
214	,, ...	,, ...	Logs ..	,, ...	Do. ...	,, ...	c.ft. ...	0-14 to 1-10
215	,, ...	,, ..	Sawn timbers ...	,, ...	Do. ...	,, ...	,, ...	1-8 to 2-8
216	,, ...	,, ..	Sleepers B. G. ...	,, ...	Do. ...	,, ...	each ...	5 to 8
217	,, ...	,, ...	,, M. G. ...	,, ..	Do. ...	,, ...	,, ...	2-8 to 2-12
218	,, ..	,, ...	,, N. G. ...	,, ...	Do. ...	,, ..	,, ..	1-8 to 1-12

219	*Sandan* ...	*Ougeinia dalbergioides.*	Round logs ...	Ballarsh ah Depôt, G. I. P. Ry.	See 11	Decr. 1923	c.ft. ...	1-10 to 1-12
220	,, ...	,, ...	Rough squared logs	,, ...	Do. ...	,, ...	,, ...	2
221	,, ...	,, ...	Logs ...	Itarsi ...	See 6 ...	Septr. 1923	,, ...	2 to 2-8
222	,, ...	,, ...	,, ...	,, ..	Daulat Din, Contractor, Itarsi.	,, ...	,, ...	2-8 to 3
223	*Semal* ...	*Bombax malabaricum.*	See *letpan.*					
224	*Shisham* ...	*Dalbergia Sissoo*...	Logs ...	Changa Manga.	See 34 ...	Novr. 1923	c.ft. ..	1-1-6 to 2-2-5
225	,, ..	,, ...	Billets ...	,, ...	Do. .	,, ...	,, ..	1-1-9
226	,, ...	,, ..	Selected Fuel ..	,, ...	Do. ...	,, ...	% c.ft.	25-11-6
227	,, ...	,, ..	Ordinary ,, ..	,, ...	Do. ...	,, ...	,, ...	13-6-4
228	*Shisham* and Mulberry mixed.	*Delbergia Sissoo and Morus Indica.*	Selected fuel ...	,, ...	Do. ...	,, ...	,, ...	22
229	,, ...	,, ...	Thick thinnings ...	,, ...	Do. ...	,, ...	,, ...	7-9-9
230	,, ...	,, ..	Thin fellings ...	,, ...	Do. ..	,, ...	% c.ft	22-2
231	,, ..	,, ...	Thin thinnings ...	,, ...	Do. ..	,, ...	,, ..	22-2
232	*Shisham* ...	*Dalbergia latifolia*	Logs ...	Calicut ...	See 18 ..	Novr. 1923	c.ft . .	2 to 5-8
233	,, ...	,, ...	Sawn logs ...	,, ...	Do. ...	,, ..	,, ...	3 to 7
234	,, ...	,, ...	Scantlings ...	,, ..	Do. ...	,, ...	,, ...	3 to 10
235	,, ...	,, ...	Round logs ...	Ballarsh ah Depôt, G. I. P. Ry.	See 11 ...	Decr. 1923	,, ..	2-4 to 2-8
236	,, .	,, ...	Rough squared logs	,, ...	Do. ...	,, ...	,, ...	2-6 to 3
237	Spruce ...	*Picea Morinda* ...	See *rai.*					
238	*Taukkyan*...	*Terminalia tomentosa.*	See *asan.*					
239	*Taungpinne*	See *Ainee.*						
240	Teak ...	*Tectona grandis* ...	Selected India, I class.	Calcutta ...	The Manager, Calcutta Price Current and Money Market Report, Calcutta.	,, ...	ton of 50 c.ft.	210

Item No.	Trade name	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices
1	2	3	4	5	6	7	8	9
								Rs. Rs.
241	Teak	*Tectona grandis*	Logs	Quilon, S. I.	See 3	Novr. 1923	c.ft.	2-12
242	,, ...	,, ...	Scantlings ...	Kallai, S. I	See 1	Jany. 1924	,, ..	6 to 8
			Logs ...	,, ...	Do ...	,, ...	,, ...	2-8 to 3-8
243	,, ...	,, ...	Unsawn logs	Pollachi, South Indian Ry.	See 10 ...	Novr. 1923	,, ...	1-1 to 2-9
244	,, ...	,, ...	Sawn logs ...	,, ...	Do. ...	,, ...	,, ...	2
245	,, ...	,, ...	Logs Round 5′ and over in girth.	Ballarshah Depôt, G. I. P. Ry	See 11 ...	Decr. 1923	,, ...	2-12 to 3-12
246	,, ...	,, ...	Logs Rough Squared 5′ and over in girth.	,, ...	Do ...	,, ...	,, ...	3 to 4
247	,, ...	,, ...	Logs Round 4′ to 4′ 11″ in girth.	,, ...	Do. ...	,, ...	,, ...	2 to 2-9
248	,, ...	...	Logs Rough Squared 4′ to 4′ 11″ in girth.	,, ...	Do. ...	,, ...	,, ...	2 3 to 2-12
249	,, ...	,, ...	Logs Round 3′ to 3′ 11″ in girth.	,, ...	Do. ...	,, ...	,, ...	1-8 to 2-2
250	,, ...	,, ...	Logs Rough Squared 3′ to 3′ 11″ in girth.	,, ...	Do. ...	,, ...	,, ...	1-11 to 2-5
251	,, ...	,, ...	Poles under 15″ girth	,, ...	Do. ...	,, ...	piece ...	1
252	,, ...	,, ...	Poles 15″—20″ girth.	,, ...	Do. ...	,, ...	,, ...	1-5

253	,, ...	,, ...	Poles 20″—24″ girth.	,, ...	Do. ...	,, ...	,, ...	1-14		
254	,, ...	,, ...	Poles 3″ D. × 12′ and over.	Godhra and C Udaipur	See 18 ...	Novr. 1923	score ...	10		
255	,, ...	,, ...	Scantlings small	,, ...	Do. ...	,, ...	c.ft. ...	1-8	to	2-4
256	,, ...	,, ...	Scantlings large	,, ...	Do. ...	,, ...	,, ...	2-8	to	4
257	,, ...	,, ...	Small logs	,, ...	Do. ...	,, ...	ton ...	50		
258	,, ...	,, ...	Big size logs	,, ...	Do.	,, ...	,, ...	80		
259	,, ...	,, ...	Fire woo ...	,, ...	Do. ...	,, ...	,, ...	7	to	10
260	,, ...	,, ...	Rough squares	Calcutta ...	See 3 ...	,, ...	,, ...	142-8		
261	Teak above 10 tt candies.	,, ...	Logs	Baypore Depôt.	District Forest Officer, Nilambur.	,, ...	c.ft. ...	3-8		
262	Teak above 4 candies.	,, ...	,, ...	,, ...	Do. ...	,, ...	,, ...	2-8	to	3-2
263	Teak above 2 candies.	,, ...	,, ...	,, ...	Do. ...	,, ...	,, ...	2-4		
264	Teak below 2 candies.	,, ...	,, ...	,, ...	Do. ...	,, ...	,, ...	2-1		
265	Teak ...	,, ...	Poles 1st Class ...	,, ...	Do. ...	,, ...	each ...	1-12		
266	,, ...	,, ...	Scantlings ...	Quilon, S. I.	See 3 ...	,, ...	c.ft. ...	6-4		
267	,, ...	,, ...	Planks ...	,, ...	Do. ...	,, ...	,, ...	6-14		
268	,, ...	,, ...	Logs ...	Itarsi ...	See 6 ...	Septr. 1923	,, ...	0-14	to	2
269	,, ...	,, ...	Poles ...	,, ...	Do. ...	,, ...	pole ...	0-12	to	1
270	,, ...	,, ...	Logs ...	,, ...	Do. ...	,, ...	c.ft. ...	2-8	to	3
271	,, ...	,, ...	Rough timber 3′ in length.	Sohag ...	Ahmad Husain, Contractor, Sohagpur.	...	...	...		
272	,, ...	,, ...	,, ...	,, ...	Do. ...	Septr. 1923	c.ft. ...	1-8		
273	,, ...	,, ...	Sawn timber below 6′ in length.	,, ...	Do. ...	,, ...	,, ...	2-4		
274	,, ...	,, ...	Sawn timber above 6′ in length.	,, ...	Do. ...	,, ...	,, ...	2-12		

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices.	
1	2	3	4	5	6	7	8	9	
275	Teak, C. P.	*Tectona grandis* ...	Rough squared logs.	Timarni or Rahatgaon.	The Manager, the Raja Barari Estate, Timber and Saw Mills, Timarni or Rahatgaon *viâ* Timarni.	Septr. 1923	c.ft. ...	Rs. 1 to Rs. 2-8	
276	,, ...	,, ...	Sawn wood scantlings and planks.	,, ...	Do ...	,, ...	,, ...	2-8 to 6	
277	,, ...	,, ...	Logs of and above 10 c.ft.	Mangalore & Kasargod.	See 16 ...	Decr. 1923	c.ft. ...	3	
278	,, ...	,, ...	Logs below 10 c ft.	,, ...	Do. ...	,, ...	,, ...	1-12	
279	,, ...	,, ...	Sawn scantlings ...	,, ...	Do. ...	,, ...	,, ...	3-12	
280	,, ...	,, ...	* * * * ...	Rangoon ...	Divisional Forest Officer, Depôt and Agency.	,, ...	ton ...	63-7-8	
281	,, ...	,, ...	* * * ...	,, ...	Do. ...	,, ...	,, ...	43-10-4	†Auction.
282	,, ...	,, ...	* * ...	,, ...	Do. ...	,, ...	,, ...	28-2-3	
283	,, ...	,, ...	* ...	,, ...	Do. ...	,, ...	,, ...	17-1-10	
284	,, ...	,, ...	D ...	,, ...	Do. ...	,, ...	,, ...	23-9-4	
285	*Thadan* ...	*Grewia latifolia*	Unsawn logs ...	Pollachi, South Indian Ry.	See 10 ...	,, ...	c.ft. ...	0-14	
286	*Tirwa* ...	*Xylia dolabriformis.*	Logs ...	Mangalore Kasargod.	See 16 ...	Decr. 1923	,, ...	0-15 to 1-8	
287	*Thitpok* ...	*Tetrameles nudiflora.*	See *baing.*						
288	*Tiwas* ...	*Ougeinia dalbergioides.*	See *sandan.*						

289	*Tun* ...	*Cedrela Toona* ...	[Cedar See Red.					
290	*Vellamaradu.*	*Terminalia paniculata.*	See *kindal.*					
291	*Vengai* ...	*Pterocarpus marsupium.*	See *bija.*					
292	Venteak ...	*Lagerstræmia lanceolata.*	Unsawn logs ...	Pollachi, South Indian Ry.	See 10 ...	Novr. 1923	c.ft. ...	0·13
293	*White Chauglam.*	*Terminalia bialata*	Squares ...	Calcutta ...	See 30 ...	Jany. 1924	ton ...	85
	,, ...	,, ...	Scantling ...	,, ...	Do. ...	,, ...	,, ...	90 to 140
294	White Dammar.	*Veteria indica* ...	See *dhupa.*					

†† Candi is equal to 800 lbs.

NOTE † Following are the specifications for the Burma Teak quotations which appear above from item No. 280 to No. 284 :—

B-1 or **** : All logs 8 feet and up which contain not more than two standard defects and have a minimum diameter of 15 inches at top end.

B-2 or *** : All logs 8 feet and up containing three standard defects and having a minimum diameter at top end of 12 inches.

C-1 or ** : Logs of all qualities worse than those which would qualify for *** with a minimum diameter at top end of 12 inches.

C-2 or * : Logs of all qualities less than 12 inches top diameter except such as are classed in D.

D : Houseposts.—Small straight logs to meet the demand for houseposts should be placed in this class whether they actually come under any of the above classes or not.

E : Crooks.—Crooked logs suitable for shipbuilding to be placed in this class whether they fall in one of the other classes or not.

1. This list of quotations is issued as a general guide, and neither the Forest Economist nor the officers or firms quoting are in any way bound to prices given in column 9.

2. Further quotations are invited. They are inserted free of charge and should reach the Office of the Forest Economist, Forest Research Institute, Dehra Dun, U. P., by the 8th instant monthly. Even though rates remain the same it is a great help if Divisional Forest Officers send in quotations monthly so that readers then know that the rates are up-to date.

3. Enquiries regarding the technical properties and identification of timbers may be addressed to the Forest Economist, Forest Research Institute, Dehra Dun, United Provinces.

4. Notices of Auctions should reach the Forest Economist by the 8th of the month previous to that in which the auction is to be held.

DEHRA DUN:
The 15th January 1924.

H. TROTTER,
Assistant Forest Economist.

QUOTATIONS FOR MINOR FOREST PRODUCTS.

Names of Products.	Market for which quoted.	Latest prices received.	Per	REMARKS.
Bees-wax	Calcutta ...	Rs. 50 to Rs. 65	md.	
,, E. I. Yellow	London ...	†£3 15*s.* to £4 10*s.*	cwt.	
Belladonna Root	,, ...	†47*s.* 6*d.*	,,	
Camphor—Japan	,, ...	†3*s.* 9*d.*	lb.	
,, ,, ...	Calcutta ...	Rs. 280 to Rs. 300	Fy. md.	Fy. md. = 74 lbs.
Cardamoms—bleached bags	New York	†Rs. 3-4-2 to Rs. 5-6-6	lb.	
Cutch	London ...	†40*s.* to 45*s.*	cwt.	
,, Red Tablets...	Rangoon ...	†Rs. 95 to Rs. 100	% Viss.	Viss 3·6 lbs.
,, Black ,, ...	,, ...	†Rs. 75 to Rs. 80	,,	
,, Block ,, ...	,, ...	†Rs. 62-8 to Rs. 65	,,	
,, Soft ,, ...	,, ...	†Rs. 54 to Rs. 56	,,	
Elephant Tusks—				
(50 lbs. and above)	Assam ...	Rs. 27-6-3	seer	Auction.
(50 lbs. and up, soft)	London ...	†£80 to £123	cwt.	
Small tusks (under 50 lbs.)	Garo Hills, Assam.	Rs. 20	seer	Local sales.
,, ,, ,, ,, ...	Kamrup Dn., Assam.	Rs. 29	,,	,,
,, ,, ,, ,, ...	Cachar Divn., Assam.	Rs. 13 to Rs. 25-12	,,	Auction.
Fibres and Flosses—				
Coir Fibre	Calcutta ...	Rs. 5 to Rs. 7-7	md.	In bales of 200 lbs.
Kapok (Floss)	,, ...	Rs. 55 to Rs. 56	,,	Do. 165 ,,
,, (Fibre)	London ...	†10½*d.* to 11¾*d.*	lb.	
Kitool	,, ...	†5½*d.* to 1*s.* 1*d.*	,,	
Rhea or China grass	,, ...	†56*s.* to 57*s.*	ton	
Gambier	,, ...	†50*s.*	cwt.	

Gums—Arabic, firsts	New York	†Re. 0-13-3 to Re. 0-14	lb.	
Kino	,,	†Re. 1-10 to Re. 1-11-8	,,	
Olibanum	London	†80*s.* to 95*s.*	cwt.	
,, siftings	New York	†Re. 0-4-5 to Re. 0-4-10	lb.	
Hides—Cow (arsenic)	Calcutta	Rs. 8 to Rs. 22-8	20 lbs.	
East India	London	†4*d.* to 10*d.*	lb.	
Buffalo	Calcutta	Rs. 6 to Rs. 11-8	20 lbs.	
Lac Seed	London	†500*s.*	cwt.	
Lac (Stick, Kusmi)	,,	†230*s.* to 240*s.*	,,	
Mowra Seed	Bombay	Rs. 9-12	,,	
Myrobalans—				
Central Provinces	London	†7*s.* 9*d.*	cwt.	
Bombay	,,	†8*s.* 9*d.*	,,	
Indian	Calcutta	Rs. 2 to Rs. 2-12	md.	
,,	,,	Rs. 3-4 to Rs. 3-12	,,	Crushed nuts.
Nux Vomica—Indian	Calcutta	Rs. 6-8 to Rs. 7-8	,,	
Buttons	New York	†Re. 0-2-7 to Re. 0-3-5	lb.	
Oils—				
Eucalyptus	London	2*s.* 6*d.* to 2*s.* 7*d.*	,,	
Citronella	,,	†4*s.* 3*d.* to 4*s.* 8*d.*	,,	
Lemon	,,	†3*s.*	,,	
Lemon Grass	,,	†2½*d.*	oz.	
Sandalwood	New York	†Rs. 22-12-7 to Rs. 23-9-7	lb.	
Rosha Grass	Bombay	Rs. 18-8	seer	
Vetivert Indian	New York	†Rs. 48-13-6 to Rs. 58-9-6	lb.	
Red Sanders	London	†£12	ton	

Names of Products.	Market for which quoted.	Latest prices received.	Per	REMARKS.
Rosin "F" Grade, American ...	Bombay ...	Rs. 10-1-9	md.	
" "G" " "	Calcutta ...	Rs. 60 to Rs. 65	barrel	Barrel = 4 cwt.
" "G" " "	London ...	†13*s.* 6*d.*	cwt.	
" "G" " "	Calcutta ...	Rs. 14	"	
" I " "	New York	†Rs. 18-12	barrel	Barrel = 280 lbs.
" I " "	London ...	†13*s.* 9*d.*	cwt.	
" K " "	New York	†Rs. 18-12	barrel	Barrel = 280 lbs.
" M " "	" ...	†Rs. 19-1-2	"	Do.
" N " "	" ...	†Rs. 20-0-8	"	Do.
" WG " "	" ...	†Rs. 21-2-6	"	Do.
" WG " "	London ...	No quotation.	"	
" WW " "	New York	†Rs. 22-12-7	barrel	Barrel = 280 lbs.
" WW " "	London ...	†16*s.* 3*d.*	"	
" Indian Government, Jallo Factory ...	Karachi ...	Rs. 12	md.	
" " " ...	Bombay ...	Rs. 12-4	cwt.	
" Indian Government (Clutterbuckganj Factory).	Calcutta ...	Rs. 10 to Rs. 10-8	md.	
" " " ...	Madras ...	Rs. 11-3	"	
Rubber, Indian	Calcutta ...	Rs. 15 to Rs. 50	"	
" Para	London ...	†1*s.* ½*d.* to 1*s.* ¾*d.*	lb.	
Shellac, T. N.	Calcutta ...	Rs. 150	md.	
" "	London ...	†310*s.* to 315*s.*	cwt.	
" Orange	" ...	†350*s.* to 370*s.*	"	
" A. C. Garnet	" ...	†275*s.* to 300*s.*	"	
" " "	Calcutta ...	Rs. 140	md.	
" Button pure	" ...	Rs. 170	"	
Spices—Pepper, India	Calcutta ...	Rs. 19 to Rs. 20	Fy. md.	
" " Tellicherry	London ...	†4½*d.* to 4⅜*d.*	lb.	
" Cinnamon	" ...	†11½*d.* to 3*s.*	"	
Tamarinds—Indian	Calcutta ...	Rs. 8 to Rs. 8-4	md.	
Thymol	London ...	†14*s.* 6*d.*	lb.	

Turpentine—			
American Spirit Spot	London ...	†72*s.* 6*d.*	cwt.
Blundel & Co.	Bombay ...	Rs. 8-0-6	gallon
Standard Oil Co.	,, ...	No quotations.	...
Hubbuck's Genuine	Calcutta ...	Rs. 8	gallon
Turpentine, Indian Government, 5 gall. drum (Jallo Factory).	Karachi ...	Rs. 31	5 gallon drum.
,, ,, ,, ...	Bombay ...	Rs. 33	,,
,, Indian Government, 5 gall. drum (Clutterbuckganj Factory).	Madras ...	Rs. 30	,,
,, ,, ,, ...	Calcutta ...	Rs. 32	,,
Wood Pulp—			
Chemical	London ...	†£13 to £19.	ton
Mechanical (moist)	,, ...	†£4 5*s.* to £4 10*s.*	,,
,, (dry)	,, ...	†£9 5*s.* to £9. 10*s.*	,,

NOTE.—† Represents rates for December 1923.

Md. indicates Bengal Maund which is equal to 82 lbs.

Prices not cross-marked in the third column are the latest market rates.

DEHRA DUN, U. P.:
The 15th January 1924.

H. TROTTER,
Assistant Forest Economist.

PUBLICATIONS RELATING TO INDIAN TIMBERS.

1. Manual of Indian Timbers, by J. S. Gamble, M.A., C.I.E., F.L.S., F.R.S.

2. Sylviculture of Indian Trees, by R. S. Troup, M.A., C.I.E., I.F.S.

3. Indian Forest Utilisation, by R. S. Troup, M.A., C.I.E., I.F.S.

4. Commercial Guide to the Economic Products of India, by R. S. Pearson, F.L.S., I.F.S.

*5. Hand Book of Forest Products of Burma, by A. Rodger, I.F.S.

6. Indian Woods and Their Uses, by R. S. Troup, M.A., C.I.E., I.F.S.

*7. A Note on Antiseptic Treatment of Indian Timbers, by R. S. Pearson, F.L.S., I.F.S.

*8. A Note on Andaman Timbers, by Martin & Co.

9. Notes for the Use of Consumers of Forest Products in the Punjab.

*10. A Further Note on the Antiseptic Treatment of Timbers, by R. S. Pearson, F.L.S., I.F.S.

11. Results of the Antiseptic Treatment of Sleepers, by R. S. Pearson, C.I.E., F.L.S., I.F.S.

*12. Bamboos for Paper Pulp, by R. S. Pearson, F.L.S., I.F.S.

*13. Bamboos for Paper Pulp, by W. Raitt, F.C.S.

*14. Paper Pulp Supplies from India, by W. Raitt, F.C.S.

*15. Seasoning of Timbers, by R. S. Pearson, F.L.S., I.F.S.

16. Relative strength of Nature and Plantation Grown Teak.

17. Further Experiments in the Air-Seasoning of Timbers & General Recommendations as to Seasoning Methods, by C. V. Sweet, B.S., M.F.

18. Note on Gumhar (*Gmelina arborea*).

*19. Note on Bija Sal (*Pterocarpus Marsupium*).

*20. Note on Sain (*Terminalia tomentosa*).

*21. Note on Benteak (*Lagerstræmia lanceolata*)

*22 Note on Sandan (*Ougenia dalbergioides*).

*23. Note on Dhaura (*Anogeissus latifolia*).

*24. Note on Blackwood (*Dalbergia latifolia*).
*25. Note on Dhauri (*Lagerstræmia parviflora*).
*26. Note on Sundri (*Heritiera minor*).
*27. Note on Red Sanders (*Pterocarpus santalinus*).
*28. Note on Babul (*Acacia arabica*).
*29. Note on Kokan (*Duabanga sonneratioides*).
*30. Note on Hollong (*Dipterocarpus pilosus*).
*31. Note on Pyinma (*Lagerstræmia Flos-Reginæ*).
*32. Note on Indian Sumach (*Rhus Cotinus*).
*33. Note on Haldu (*Adina cordifolia*).
*34. Note on Odina Wodier.
*35. Note on Semal (*Bombax malabaricum*).
*36. Note on Burmese Leza Wood (*Lagerstræmia tomentosa*).
*37. Note on Carallia Wood (*Carallia integerrima*).
*38. Note on Petwun (*Berry Ammonilla*).
*39. Burmese In Wood (*Dipterocarpus tuberculatus*).
*40. Burmese Padauk (*Pterocarpus macrocarpus*).
*41. Andaman Marble or Zebra Wood.
*42. Note on Gurjan (*Dipterocarpus turbinatus*).
*43. Note on Thingan (*Hopea Odorata*).
*44. Note on Kindal or Hongal (*Terminalia paniculata*).

45. Mechanical, Physical and Structural properties of wood grown in India.

46. Summary of results of Treated and Untreated Experimental Sleeper laid in the various Railway Systems of India brought up-to-date, by R. S. Pearson, C.I.E.

The above publications are obtainable from

THE SUPERINTENDENT, GOVERNMENT PRINTING INDIA, Calcutta; and Messrs. Thacker Spink & Co., Calcutta.

A limited number of those marked with an asterisk are available for issue to *bonâ fide* enquirers from

THE FOREST ECONOMIST,
FOREST RESEARCH INSTITUTE, *DEHRA DUN.*

N.B.—**Copies of Item Nos. 4, 6, 17, 18, 29, 43, 45 and 46 can also be had on payment from the Librarian, Forest Research Institute and College, Dehra Dun, U. P.**

COASTWISE EXPORTS OF TIMBER FROM BURMA.

Statement showing the quantity and value of Teak Wood and other timber exported coastwise from Burma to the different maritime provinces of British India during November 1923.

Provinces to which exported.	Teak wood.		Other timber.	
	Quantity.	Value.	Quantity.	Value.
	Cubic tons.	Rs.	Cubic tons.	Rs.
To Bengal	3,695	5,55,507	387	44,648
„ Bombay	4,495	6,73,901	30	1,973
„ Sind	...	...	...	...
„ Madras	2,862	3,98,297	...	120
Total ...	11,052	16,27,255	421	47,058

Statement showing the quantity and value of the different descriptions of timber, other than railway sleepers, imported by sea from abroad into the different maritime provinces of British India during the month of November 1923.

Share of Province.	Deal and pine wood.		Jarrah wood.		Teak wood.		Other timber.	
	Cubic tons.	Rs.	Cubic tons.	Rs.	Cubic tons.	Rs.	Cubic tons.	Rs.
Bengal	...	811	...	...	...	...	13	1,131
Bombay	101	13,007	...	...	750	1,20,993	40	4,079
Sind	46	4,634	...	...	...	...	43	1,930
Madras	1	38	...	...	...	...	118	6,519
Burma	...	...	...	...	...	2	184	15,864
Total ...	148	18,490	...	...	750	1,20,995	398	29,523

Printed and Published at the PIONEER PRESS, ALLAHABAD, by C. G. HARRIS. No. 169—1-2-'24.

QUOTATIONS FOR TIMBER.

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date	Per	Prices.
1	2	3	4	5	6	7	8	9
1	*Ainee* ...	*Artocarbus hirsuta*	Logs ...	Kallai, S. I.	The Managing Agents, New Malabar Timber Yards & Saw Mills, Ltd., Kallai, S. I.	May 1924	c.ft. ...	Rs. 1-8 to Rs. 2
2	,, ...	,, ...	Scantlings ...	,, ...	Ditto. ...	,, ...	,, ...	3-8 to 4-8
3	*Amb* ...	*Mangifera indica*...	Logs ...	Quilon, S. I.	Harrison & Crosfield Ltd., Quilon.	Feby. 1924	,, ...	0-8
4	,, ...	,, ...	Scantlings ...	,, ...	Ditto ...	,, ...	,, ...	1-0
5	,, ...	,, ...	Planks ...	,, ...	Ditto ...	,, ...	,, ...	1-3
6	,, ...	,, ...	Logs ...	Itarsi, G. I. P. Ry.	Shiam Lall, Contractor.	Septr. 1923	,, ...	0-6
7	,, ...	,, ...	,, ...	Kallai, S. I.	See 1 ..	Jany. 1924	,, ...	0-12 to 0-14
8	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	1-8 to 1-12
9	*Asna* ..	*Terminalia tomentosa.*	Logs ...	Itarsi, G. I. P. Ry.	Shiam Lall, Contractor.	Octr. 1923	,, ...	1-12 to 2-4
10	,, ..	,, ...	,, ..	Clutterbuckganj (O. & R.)	Conservator of Forests, Utilisation Circle, Bareilly.	Feby. 1924	,, ...	1-4
11	,, ...	,, ...	M. G. Sleepers 6′ × 8″ × 4½″.	,, ...	Ditto ...	,, ...	sleeper	2-4

Item No	Trade name.	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices.
1	2	3	4	5	6	7	8	9
12	*Asna* ...	*Terminalia tomentosa.*	Unsawn logs ...	Pollachi, South Indian Railway.	District Forest Officer, South Coimbatore.	April 1924	c.ft. ...	Rs. 0-9 to Rs. 0-12
12a	,, ...	,, ...	Sawn logs ...	,, ...	Do. ...	,, ...	,, ...	0-11
13	,, ...	,, ...	Round logs ...	Ballarshah Depôt, G. I. P. Ry.	Divisional Forest Officer, South Chanda, C. P.	Feby. 1924	,, ...	1-2 to 1-8
14	,, ...	,, ...	Rough squared logs.	,, ...	Do. ...	,, ...	,, ...	1-4 to 1-9
15	,, ...	,, ...	Logs ...	Quilon, S. I.	See 3 ...	,, ...	,, ...	1-4
16	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	3-8
17	,, ...	,, ...	Planks ...	,, ...	Do. ...	,, ...	,, ...	3-12
18	,, ...	,, ...	Logs ...	Mangalore & Kasargod, S. I. Ry.	Divisional Forest Officer, South Mangalore.	,, ...	,, ...	1-3 to 1-8
19	,, ...	,, ...	Sawn scantlings ...	,, ...	Do. ...	,, ...	,, ...	1-12 to 2-4
20	,, ...	,, ...	Round Logs ...	Nagpur ...	G. B. Titi, Esq., Post Box No. 900, Bombay.	Novr. 1923	ton ...	60
21	,, ...	,, ...	,, ...	Godhra ...	Do. ...	,, ...	,, ...	40
22	,, ...	,, ...	,, ...	Udaipur ...	Do. ...	,, ...	,, ...	40
23	,, ...	,, ...	Hewn squared logs.	Nagpur ...	Do. ...	,, ...	,, ...	70
24	,, ...	,, ...	,, ...	Godhra ...	Do. ...	,, ...	,, ...	45
25	,, ...	,, ...	,, ...	Udaipur ...	Do. ...	,, ...	,, ...	50
26	,, ...	,, ...	B. G. Sleepers 9′ × 16″ × 5″.	Nagpur or Bilaspur.	Do. ...	,, ...	each ...	5

27	,, ...	,, ...	M. G. 6′ ×8″ ×4½″	Bilaspur ...	Do. ...	,, ...	,, ...	2-2
28	,, ...	,,	N. G. ...	Godhra or C. Udaipur.	Do. ...	,, ...	,, ...	1-8
29	,, ...	,, ...	Sawn squared ...	Jharsuguda	Do. ...	,, ...	ton ...	65
30	,, ...	,, ...	,, ...	C. Udaipur	Do. ...	,, ...	,, ..	55
31	,, ...	,, ..	Sawn scantlings ...	F. O. R. Bombay.	Do. ...	,, ..	c.ft. ...	2-0
32	,, ...	,, ...	Logs ...	Kallai, S. I.	See 1 ...	May 1924	,, ...	1-8 to 2
33	,, ...	,, ...	,, ...	Mangalore North.	Divisional Forest Officer, North Mangalore.	,, ...	,, ...	0-7 Auction.
34	,, ...	,, ...	Machine sawn beams and scantlings.	Berhampur, Ganjam Dt., B. N. Ry.	Agent, Government Sawmills, Russelkonda, Ganjam District.	,, ...	,, ...	2-14-6
35	,, ...	,, ...	Logs ...	Wynad Forest Division.	District Forest Officer, Wynad.	March 1924	,, ...	1-0 to 1-10 Auction.
36	*Badam* ...	*Terminalia procera*	Squares ...	Calcutta ...	Martin & Co., Calcutta.	,, ...	ton ...	75
37	,, ...	,, ...	Scantlings ...	...	Do. ...	,, ...	,, ...	80 to 120
38	*Bahan* ...	*Populus euphratica*	Billets 3′ long and above 3′ in girth.	Ghazi ghat, N.-W. Ry.	Divisional Forest Officer, Multan, Punjab.	,, ..	c.ft. ...	0-8
39	*Babul* ...	*Acacia arabica* ...	Firewood ...	Poona ...	S. G. Patankar, Secretary, Forest Merchants' Association, Poona City.	Novr. 1923	khandi	9-0 to 10-0
40	,, ...	,,	Logs ...	Changa Manga.	Divisional Forest Officer, Northern Plantation Division, Lahore.	,, ...	c.ft. ...	0-10
41	*Bakain* ...	*Melia Azedarach.*	,, ...	,, ...	Ditto ..	,, ...	,, ...	1-5-3
42	*Baing* ...	*Tetrameles nudiflora*	,, ...	Kallai, S. I.	See 1 ..	May 1924	,, ...	0-9 to 0-12
43	,, ...	,,	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	1-8 to 2
44	*Beembo* ...	*Adina cordifolia*	See *haldu*.					
45	Benteak ...	*Lagerstræmia microcarpa.*	Sawn Scantlings ...	Kallai, S. I.	See 1 ...	,, ...	c.ft. ...	3-8 to 4-0
46	.. ...	,, ...	Logs ...	.. ..	Do. ...	.. ...	,, ...	1-4 to 1-8

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date	Per	Prices.
1	2	3	4	5	6	7	8	9
								Rs. Rs.
47	*Bija* ..	*Pterocarpus Marsupium.*	Round logs ...	Ballarshah Depôt, G. I. P. Ry.	See 13 ...	Feby. 1924	c.ft ...	1-3 to 1-6
48	,, ...	,, ...	Rough squared logs.	,, ...	Do. ...	,, ...	,, ...	1-4 to 1-7
49	,, ...	,, ...	Logs ...	Itarsi ...	See 6 ...	Septr. 1923	,, ...	0-12
50	,, ...	,, ...	,, ...	Mangalore and Kasargod.	See 18 ...	March 1924	,, ...	1-8
51	,, ...	,, ..	,, ...	Wynad Forest Division.	See 35 ...	March 1924	,, ...	1-1 Auction.
52	,, ...	,, ...	,, ...	F. O. R., G. I. P. & B. N. Ry. Stations.	See 20 ...	Novr. 1923	,, ...	1-8
53	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	2-4
54	,, ...	,, ...	,, ...	Godhra ...	Do. ...	,, ...	,, ...	1-8 to 3-0
55	,, ...	,, ...	Logs ...	Mangalore North.	See 33	Jany. 1924	,, ...	0-11 Auction.
56	,, ...	,, ...	Machine sawn beams and scantlings.	Berhampur, Ganjam District, B. N. Ry.	See 34 ...	,, ...	,, ...	3-0 to 3-4
57	Black Dammar.	*Dipterocarpus indicus.*	Logs ...	Kallai, S. I.	See 1 ...	May 1924	,, ...	1-4 to 1-8
58	Black wood	*Dalbergia latifolia*	,, ...	Calicut ...	See 20 ...	Novr. 1923	c.ft. ..	2-0 to 5-8
59	,, ...	,, ...	Sawn logs ...	,, ...	Do. ...	,, .	,, ..	3 0 to 7-0

60	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	Novr. 1923	,, ...	3-0 to 10-0
61	,, ...	,, ...	Round logs ..	Ballarsh a h Depôt, G. I. P. Ry.	See 15 ...	Feby. 1924	,, ..	3-0 to 8-0
62	,, ...	,, ...	Rough squared logs	,, ...	Do. ...	March ...	,, ...	3-2 to 4-0
63	,, ..	,, ...	Logs ...	Mangalore North.	See 33 ...	Jany. 1924	,, ..	0-11 Auction.
64	,, ...	,, ...	Logs unsawn ...	Pollachi, S. I	See 12 ...	Feby. 1924	,, ..	1-9 to 2-11
65	,, ...	,, ...	Scantlings ...	,, ...	Do.			
66	Blue Pine	*Pinus excelsa* ...	,, ...	Jhelum ...	Divisional Forest Officer, Jhelum.	,, ...	,, ...	3-4 to 3-8
67	Cedar Red	*Cedrela Toona* ...	Logs ...	Kallai, S. I.	See 1 ...	April 1924	,, ...	0-9 to 1-15
68	*Chil* or *Chir*	*Pinus longifolia* ...	Sleepers 12′ ..	Lalta Rao Depôt.	Depôt Forest Officer, Lalta Rao Depôt, Hardwar, U. P.	March 1924	,, ...	1-8 to 1-12
69	,, ...	,, ...	,, 12′ ...	Jagadhri ...	E. A C. River Sub-Division, Kalsi P. O., Dis. Dehra Dun.	July 1923 ...	score ...	No quotations.
70	,, ...	,, ...	,, 10′ ...	,, ...	Do. ...	April 1924	piece ...	3-8
71	,, ...	,, ...	,, 8′ ...	,, ...	Do. ...	,, ...	,, ...	3-4
72	,, ...	,, ...	,, 6′ ...	,, ...	Do. ...	,, ...	,, ...	2-8 to 3-0
73	,, ...	,, ...	Sleepers ...	Jhelum ...	See 66 ...	,, ...	,, ...	1-4
74	,, ...	,, ..	Sleepers 12′ × 10″ × 5″.	Hardwar ...	Ganga Ram & Sons, Timber Merchants, Hardwar.	April 1924	c.ft. ...	0-8-9 to 1-2-1
75	,, ...	,, ...	Karries ...	Dilwan ...	Divisional Forest Officer, Depôt, East Division, Phillaur.	Octr. 1923	piece ..	2-12 to 4-0
76	,, ...	,, ...	Sleepers ...	,, ...	Do. ...	Novr. 1923	c.ft. ..	0-6-11
						,, ...	,, ...	0-7 to 0-11-4

Item No.	Trade name.	Scientific name.	Description.	Market	Apply to	Date.	Per	Prices.	
1	2	3	4	5	6	7	8	9	
								Rs.	Rs.
77	*Chil* or *Chir*	*Pinus longifolia* ...	Logs III C. Class...	Jhelum ...	Divisional Forest Officer, Lower Jhelum Division (Kashmir State), Jhelum.	Feby. 1924	c ft. ...	...	Auction held 5th to 7th February 1924.
78	,, ...	,, ...	Beams 17′—I ...	,, ...	...	,, ...	each ...	16-0	
79	,, ...	,, ...	,, 17′—II ...	,, ...	...	,, ...	,, ...	10-2	
80	,, ...	,, ...	,, 15′—I ...	,, ...	...	,, ...	,, ...	14-2	
81	,, ...	,, ...	,, 15′—II ...	,, ...	...	,, ...	,, ...	6-5	
82	,, ...	,, ...	,, 12′—I ...	,, ...	...	,, ...	,, ...	8-14	
83	,, ...	,, ...	,, 12′—II ...	,, ...	...	,, ...	,, ...	5-12	
84	,, ...	,,	B. G. sleepers III	,, ...	...	,, ...	,, ...	1-6-3	
85	,, ...	,, ...	,, II...	,, ...	...	,, ...	,, ...	3-3	
86	,, ...	,, ...	Sleepers 8′—I ...	,, ...	...	,, ...	,, ...	2-10-3	
87	,, ...	,, ...	,, 8′—II ...	,, ...	...	,, ...	,, ...	1-8	
88	,, ...	,, ...	,, 6′—I ...	,, ...	...	,, ...	,, ...	2-1	
89	,, ...	,, ...	Ballas ...	,,	...	,, ...	,, ...	1-10	
90	*Chorpayan*	*Hardwickia pinnata*	Logs ...	Kallai, S. I.	See 1 ...	April 1924	c.ft. ...	1-0 to 1-8	
91	,, ...	,, ...	Scantlings ..	,, ...	Do. ...	,, ...	,, ...	3-0 to 3-8	
92	Deodar ...	*Cedrus Deodara* ...	Sleepers 6′ to 12′...	Jagadhri ..	See 69 ...	,, ...	piece ...	2-4 to 7-0	
93	,, ...	,, ...	,, 8′×10″ ×5″.	Hardwar ...	See 74 ...	Novr. 1923	,,	4-8	
94	,, ...	,, ...	,, 10′×11″×5″	,,	Do. ...	,, ...	,, ...	150	
95	,, ...	,, ...	Ballies 12′ ...	Dhilwan ...	See 75 ...	,, ...	c.ft. ...	0-7-6	
96	,, ...	,, ...	Sleepers ...	,, ...	Do. ...	,, ...	,, ...	0-8 to 1-8	
97	,, ...	,, ...	Gattus ...	,, ...	Do. ...	,, ...	,, ...	0-12	
98	,, ...	,, ...	Karries ...	,, ...	Do ...	,, ...	,, ...	0-14-9	

99	,,	,,	Scantlings	Jhelum	See 66		April	1924	,,	0-1 to 2-10		
100	,,	,,	Logs	,,	Do.		,,	,,	,,	1-0 to 1-12		
101	,,	,,	Logs II A class	,,	Do.		,,	,,	,,	1-11-3	Auction held 5th to 7th February 1924.	
102	,,	,,	Logs II B class	,,	Do.		,,	,,	,,	1-4		
103	,,	,,	B. G. sleepers I	,,	Do.		,,	,,	each	6-12		
104	,,	,,	,, II	,,	Do.		,,	,,	,,	4-1		
105	,,	,,	Sleepers 8′—I	,,	Do.		,,	,,	,,	5-7		
106	,,	,,	,, 8′—II	,,	Do		,,	,,	,,	3-11		
107	,,	,,	Balas	,,	Do.		,,	,,	,,	1-4		
108	*Dhup*	*Canarium euphyllum*	Scantlings	Calcutta	See 36		,,	,,	ton	85-0 to 120-0		
109	*Dhupa*	*Vateria indica*	Logs	Kallai, S. I.	See 1		,,	,,	c ft.	1 to 1-4		
110	,,	,,	,,	Mangalore and Kasargod	See 18		March.	1924	,,	0-14		
111	*Didu*	*Bombax insigne*	Scantlings	Calcutta	See 36		April	1924	ton	75-0 to 105-0		
112	Ebony	*Diospyros Ebenum*	Logs	Kallai, S. I.	See 1		,,	,,	c.ft.	6-0 to 8-0		
113	Fir	*Abies Pindrow*	Beams 17′—I	Jhelum	See 77		Feby.	1924	each	8-11-7		
114	..	,,	,, 17′—II	,,			,,	,,	,,	5-10	Auction held 5th to 7th February 1924.	
115	,,	,,	,, 15′—I	,,			,,	,,	,,	7-6-2		
116	,,	,,	,, 15′—II	,,			,,	,,	,,	4-2		
117	,,	,,	,, 12′—I	,,			,,	,,	,,	4-4		
118	,,	,,	B. G. sleepers	,,			,,	,,	,,	1-9		
119	,,	,,	Sleepers	Dhilwan	See 19		Novr.	1923	c.ft.	0-5-7 to 0-7-1		
120	,,	,,	Gattus	,,	Do.		,,	,,	,,	0-6		
121	,,	,,	Karries	,,	Do.		,,	,,	,,	0-7-9		
122	,,	,,	Scantlings	Jhelum	See 66		April	1924	,,	0-6-3 to 1-4		
123	,,	,,	Sleepers	,,	Do.		,,	,,	,,	0-5 to 0-15-6		
124	*Gumhar*	*Gmelina arborea*	Logs Round	Ballarshah	See 13		,,	,,	,,	1-3 to 1-10		
125	,,	,,	Logs Rough squared.	,,	Do.		,,	,,	,,	1-9 to 1-12		
126	*Gurjan* (Andaman)	*Dipterocarpus turbinatus.*	Squares	Calcutta	See 36		,,	,,	ton	92-8		
127	,,	,,	Scantlings	,,	Do.		,,	,,	,,	100 to 150		
128	*Gurjan* (Burma).	,,	Logs	,,	Do.		,,	,,	,,	147-8		

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices.
1	2	3	4	5	6	7	8	9
								Rs. Rs.
129	*Haldu* ...	*Adina Cordifolia* ...	Logs ...	G. I. P., B. N. R. and B. B. & C. I. Stations.	See 20 ..	April 1924	c.ft. ...	0-8 to 1-4
130	,, ...	,, ...	Round logs ...	Ballarshah Depôt, G. I. P. Ry.	See 13 ...	,, ..	,, ...	1-2 to 1-8
131	,, ...	,, ...	Rough squared logs	,, ...	Do. ...	,, ...	,, ...	1-4 to 1-9
132	,, ...	,, ...	Scantlings ...	Kallai, S. I.	See 1 ...	May 1924	,, ..	2-0
133	*Honne* ...	*Pterocarpus Marsupium.*	See *bija*.					
134	*Irool* ...	*Xylia xylocarpa* ...	Logs ...	Kallai, S. I.	Do. ...	Jany. 1924	,, ..	1-4 to 1-8
135	,, ...	,, ...	,, ...	Mangalore & Kasargod.	See 18 ...	Decr. 1923	,, ...	0-15 to 1-8
136	,, ...	,, ...	Sawn scantlings ...	,, ...	Do. ...	,, ...	,, ...	1-12 to 2-4
137	,, ..	,, ...	Logs unsawn ..	Pollachi ...	See 12 ...	Feby. 1924	,, ..	1 to 1-11
138	Jackwood...	*Artocarpus integrifolia.*	,, ...	Kallai, S. I.	See 1 ...	March 1924	,, ...	1-8 to 2-0
139	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	3-8 to 4-8
140	*Jambe* ...	*Xylia dolabriformis*	Logs ...	Mangalore North.	See 33 ...	,, ...	,, ...	0-5 Auction.

141	*Kail* ...	*Pinus excelsa* ...	Sleepers 12′ ...	Jagadhri ...	See 69 ...	April 1924	piece ...	4-0	Auction held 5th to 7th February 1924.
142	,, ...	,, ...	,, 10′ ...	,, ...	Do. ...	,, ...	,, ...	3-0	
143	,, ...	,, ...	,, 8′ ...	,, ...	Do. ...	,, ...	,, ...	2-12 to 4-8	
144	,, ...	,, ...	,, 6′ ...	,, ...	Do. ...	,, ...	,, ..	1-8 to 3-0	
145	,, ...	,, ...	Scantlings ...	Jhelum ...	See 66 ...	Feby. 1924	,, ...	0-9-6 to 1-11	
146	,, ...	,, ...	Ballas above 24″ in girth.	Dhilwan ...	See 75 ...	,, ...	c.ft. ...	0-3-6	
147	,, ...	,, ..	Ballies ...	,, ...	Do. ...	,, ...	,, ..	0-7-4	
148	,, ...	,, ...	Beams ...	,, ...	Do. ...	,, ...	,, ..	0-13-4	
149	,, ...	,, ...	Sleepers ...	,, ...	Do. ...	,, ..	,, ...	0-11 to 1-0-6	
150	,, ...	,, ...	Gattus ...	,, ...	Do. ...	,, ...	,, ...	0-6 to 1-5-3	
151	,, ...	,, ...	Karries ...	,, ...	Do. ...	,, ...	,, ..	0-12-6	
152	,, ...	,, ...	Chappas ...	Jhelum ...	See 77 ...	,, ...	,, ...	0-8-9	
153	,, ...	,, ...	Pieces ...	,, ...	Do. ...	,, ...	,, ...	0-4 6	
154	,, ...	,, ...	Tota ...	,, ..	Do. ..	,, ...	,, ..	0-2	
155	,, ..	,, ...	Beams 12′ to 15′ II class	,, ...	Do. ..	,, ...	,, ..	0-8-6 to 0-9-6	
156	,, ..	,, ...	Sleepers, B. G. ...	,, ..	Do. ..	,,	,, ...	0-10-5	
157	,, ..	,, ..	,, 8′ ..	,, ...	Do. ..	,, ..	,, ..	1-1-2	
158	,, .	,, ..	,, 6′ ..	,, ...	Do. ...	,, ..	,, ...	0-6-4	
159	,, ...	,, ...	Bala ...	,, ...	Do. ...	,, ...	each ...	0-11	
160	,, ..	,, ...	Logs II B ...	,, ..	Do. ...	,, ..	c.ft ...	0-6-3	
161	*Kalpaini* ...	*Dipterocarpus indicus.*	See black damma						
162	*Kanyin* ...	*Dipterocarpus turbinatus.*	See *gurjan.*						
163	*Karmaradu*	*Terminalia tomentosa.*	See *Asan*						
164	*Kindal* ..	*Terminalia paniculata.*	Logs ..	Kallai, S I.	See 1 ...	May 1924	each ...	1-4 to 1-8	
165	,, ..	.. ...	Scantlings ...	,, ..	Do. ...	,, ...	.. ..	3-8 to 3-12	
166	,, .	,, ...	Logs ...	Mangalore & Kasargod	See 18 ...	,, ...	c.ft ..	0-14 to 1-2	
167	.. ..	,, ...	Unsawn logs ..	Pollachi, South Indian Ry.	See 12 ...	March 1924	,, ...	0-11 to 1 3	

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices
1	2	3	4	5	6	7	8	9
168	*Kindal* ...	*Terminalia paniculata.*	Sawn Logs ..	Pollachi, South Indian Ry.	See 12 ...	March 1924	c.ft. ...	Rs. Rs. 1-3
169	,, ...	,, .	Logs ...	Quilon, S. I	See 3 ...	Feby. 1924	,, ..	1-0
170	,, ...	,, ...	Scantlings ...	,, ..	Do. ...	,, ..	,, ...	2-8
171	,, ...	,, ..	Planks ...	,, ...	Do. ...	,, ...	,, ...	2-12
172	,, ...	,, ...	Logs ..	Mangalore North.	See 33 ...	Jany. 1924	,, ...	0-11 Auction.
173	*Kiralbogi*	*Hopea parviflora*	,, ..	Mangalore & Kasargod, S. I. Ry.	See 18 ...	March 1924	,, ..	1-0 to 2-0
174	,, ..	,, ..	Sawn scantlings ...	,, ...	Do. ...	,, ..	,, ...	2-4 to 2-12
175	Koko ...	*Albizzia Lebbek* ...	Scantlings ...	Calcutta ...	See 35 ...	,, ...	ton ...	90-0 to 150-0
176	*Letpan* ...	*Bombax malabaricum.*	Logs ...	Kallai, S. I.	See 1 ...	,, ...	,, ...	0-9 to 0-12
177	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	1-8 to 2-0
178	Mango ...	*Mangifera indica*...	See *amb.*					
179	*Matti* ...	*Terminalia tomentosa.*	See *asan.*					
180	Mulberry ...	*Morus indica* ...	Logs (Green) ...	Chanda Manga	See 39 ...	April 1924	c.ft. ...	0-12 to 3-0
181	,, ...	,, ...	Logs Dry ...	,, ...	Do. ...	,, ...	,, ...	0-10-6 to 1-0
182	,, ...	,, ...	Selected Fuel ...	,, ...	Do. ...	,, ...	% c.ft.	21-4
183	,, ...	,, ..	Ordinary Fuel ...	,, ...	Do. ...	,, ...	,, ...	8-11-9
184	,,	,,	Billets ...	,, ...	Do. ...	,, ...	c.ft. ...	0-9 to 1-12
185	*Nangal* or *Nahor.*	*Mesua ferrea* ...	Logs ...	Kallai, S. I.	See 1 ...	May 1924	,, ...	2-0 to 2-4

186	Padauk (Andamans).	*Pterocarpus dalbergioides.*	Squares ...	Calcutta ...	See 35 ...	April 1924	,, ...	185-0		
187	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	150-0	to	300-0
188	Padauk (Burma).	*Pterocarpus Macrocarpus.*	Squares ...	,, ...	Do. ...	,, ...	,, ...	175-0		
189	*Pali* ..	*Dichopsis elliptica*	Logs ...	Kallai, S. I.	See 1 ...	May 1924	,, ...	1-4	to	1-8
190	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	3-0	to	3-8
191	*Pani*	*Vateria indica* ...	See *dhupa.*							
192	*Papita* ...	*Sterculia campanulata*	Scantlings ...	Calcutta ...	See 35 ..	April 1924	ton ...	70-0	to	107-8
193	*Payin* ...	*Vateria indica* ...	See *dhupa.*							
194	*Pilamarudu*	*Terminalia paniculata.*	See *kindal.*							
195	*Poon* ..	*Calophyllum tomentosum.*	Logs ...	Kallai, S. I.	See 1 ...	May 1924	c.ft. ...	1-4	to	1-8
196	,, ...	,, ...	Scantlings ...	,, ...	Do. ...	,, ...	,, ...	3-0	to	3-8
197	*Pula* ..	*Bombax malabaricum.*	See *letpan.* ...							
198	,,	,, ...	Logs ..	Calcutta ...	See 36 ...	April 1924	ton ...	100-0		
199	*Pulibagi*	*Albizzia odoratissima.*	,, ..	Mangalore & Kasargod.	See 18 ...	March 1924	c.ft ..	0-12	to	1-0
200	*Pyinma* (Andaman)	*Lagerstræmia hypoleuca.*	Squares ...	Calcutta ...	See 36 ...	April 1924	ton ...	120-0		
201	,, ...	,,	Scantlings ...	,, ...	Do ...	,, ...	,, ...	100-0	to	150-0
202	*Pyinslado*	*Xylia dolabriformies*	Logs ...	,, ...	Do. ...	,, ...	,, ...	105-0		
203	*Kedpayan* ..	*Hardwickia pinnata.*	See *chorapayan.*							
204	Rosewood...	*Dalbergia latifolia*	See "Blackwood."							
205	*Sahajo* ...	*Terminalia tomentosa.*	See *asna.*							
206	*Sain* ...	,, ..	,,							
207	*Saj* ...	,,	,,							
208	*Sal* ...	*Shorea robusta*	Logs ...	Sapatagram	Divisional Forest Officer, Goalpara Division, Assam.	May 1924	c.ft. ...	1 4	to	1-9

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices.
1	2	3	4	5	6	7	8	9
								Rs Rs
209	*Sal* ...	*Shorea robusta* ...	B.G. Sleepers ...	Dhamtari, C. P.	Divisional Forest Officer, South Raipur Division, Raipur, C. P	April 1924	each ...	9-0
210	,, ...	,, ...	M. G. ,, ...	,, ...	Do. ...	,, ..	,, ...	No quotations Ditto.
211	,, ...	,, ...	N. G. ,, ...	,, ...	Do. ...	,, ..	,, ...	
212	,, ...	,, ...	M. G. Sleepers 6′×8″×4½″ (2nd quality).	Clutterbuckgunj (O. & R. Ry.	Divisional Forest Officer, Dehra Dun.	,, ..	piece .	2-0
213	,, ...	,, ..	B. G. Sleepers ...	Kusmi, B. N. W. Ry.	Indian Products Association, Gorakhpur.	June 1923	ton ...	160-0
214	,, ...	,, ...	M. G. ,, ...	,, ...	Do. ...	,, ..	,, ..	50-0
215	,, ...	,, ...	N. G. ,, ...	,, ...	Do. ...	March 1924	score ...	35-0
216	,, ...	,, ...	Scantlings ...	,, ...	Do. ..	,, ..	ton ..	150-0 to 175-0
217	,, ...	,, ..	Sal Planks ...	,, ..	Do. ...	,, ...	,, ..	175-0
218	,, ..	,, ...	Crossing Sleepers 12′×10″×5″.	Haldwani ...	Divisional Forest Officer, Haldwani.	March 1924	pieee...	13-0
219	,, ...	,, ..	B.G. Sleepers 9′×10″×5″.	Western Circle Division (O. R. and R. K. Railways).	See 10.			
220	,, ...	,, ..	M. G. Sleepers ... 6′×8″×4½″.	,, ...	Do. ..	March 1924	price ..	3-5
221	,, ...	,, ...	M. G. Sleepers ...	Eastern Circle Divisions	Do. ...	Feby. 1924	Sleeper	2-15
222	,, ...	,, ...	B. G. Sleepers ..	,, ..	Do. ...	,, ...	,,	8-8
223	,, ...	,, ...	Logs ...	Calcutta ..	See 36 ...	,,	c.ft. ...	2-5 to 3-1

224	,, ...	,, ..	Machine sawn scantlings 6′ 0″ and up.	Berhampore, Ganjam, B. N. Ry.	The Agent, Government Sawmills, Russellkonda, Ganjam.	Septr. 1923	,, ...	2-14-6 to 3-4
225	,, ...	,, ...	Beams ...	,, ...	Do. ..	,, ...	,, ...	3-4 to 4-0
226	,, ..	,, ..	Logs ..	Bilaspur ...	See 20 ...	Novr. 1923	,, ...	1-4
227	,, ...	,, ...	Scantlings ..	Nagpur ...	Do. ...	,, ...	,, ...	1-8 to 4-0
228	,, ..	,, ..	Sawn squares ...	,, ..	Do. ..	,, ...	,, ...	2-0 to 3-0
229	,, ..	,, ..	B. G. Sleepers ...	Buxa Duar (nearest Ry. station, Buxa Road).	Divisional Forest Officer, Buxa Division (Bengal).	1923-24 ...	piece ..	8 0
230	,, ...	,, ..	M. G. ,, ...	,, ...	Do ..	,, ...	,, ...	3-4
231	,, ...	,, ...	Sleepers specials ...	,, ...	Do. ...	,, ..	c.ft. ...	3-2 to 3-8
232	,, ...	,, ...	Poles 7″ to 12″ diameter.	Sonua ...	Divisional Forest Officer, Singhbhum Division, Chaibassa.	Novr. 1923	piece ...	1-4 to 4-0
233	,, ...	,, ...	Logs ..	,, ..	Do. ...	,, ...	c.ft. ...	0-14 to 1-10
234	,, ...	,, ..	Sawn timbers ...	,, ..	Do. ...	,, ...	,, ...	1-8 to 2-8
235	,, ...	,, ..	Sleepers B. G. ...	,, ...	Do. ...	,, ...	each ...	5-0 to 8-0
236	,, ...	,, ...	,, M. G. ...	,, ...	Do. ...	,, ...	,, ..	2-8 to 2-12
237	,, ..	,, ...	,, N. G. ...	,, ..	Do. ...	,, ..	,, ..	1-8 to 1-12
238	*Sandan* ...	*Ougeinia dalbergioides.*	Round logs ...	Ballarshah Depôt, G. I. P. Ry.	See 13	Feby. 1924	c.ft. ...	2-0
239	,, ..	,, ...	Rough squared logs	,, ...	Do. ...	,, ...	,, ...	2-2
240	,, ...	,, ...	Logs ...	Itarsi .	See 6 ...	Septr. 1923	,, ...	2-0 to 2-8
241	,, ...	,, ...	,, ...	,, ..	Daulat Din, Contractor, Itarsi.	,, ...	,, ...	2-8 to 3-0
242	*Semal* ...	*Bombax malabaricum.*	See *letpan.*					
243	*Shisham* ...	*Dalbergia Sissoo*...	Logs ...	Changa Manga.	See 66 ...	April 1924	,, ..	1-3 to 1-8
244	,, ...	,, ...	Selected Fuel ...	,, ...	Do. ...	,, ...	% c.ft.	26-10
245	,, ...	,, ..	Ordinary ,, ..	,, ...	Do. ...	,, ...	,, ...	11-4-7
246	Spruce ...	*Picea Morinda* ...	See *rai*					
247	*Taukkyan*...	*Terminalia tomentosa.*	See *asan.*					

Item No.	Trade name.	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices.
1	2	3	4	5	6	7	8	9
248	*Taungpinne*	See *Ainee*.						
249	Teak ...	*Tectona grandis* ...	Selected India, I class.	Calcutta ...	The Manager, Calcutta Price Current and Money Market Report, Calcutta.	April 1924	ton of 50 c.ft.	Rs. Rs. 190-0 to 195-0
250	,, ...	,, ...	Logs ...	Quilon, S. I.	See 3 ...	Feby. 1924	c.ft.	No quotations.
251	,, ...	,, ...	Scantlings ...	Kallai, S. I.	See 1 ...	May 1924	,, ...	6-0 to 8-0
			Logs ...	,, ...	Do ...	,, ...	,, ...	2-8 to 8-0
252	,, ...	,, ...	Unsawn logs ...	Pollachi, South Indian Ry.	See 12 ...	April 1924	,, ...	1-2 to 3-3.
253	,, ...	,, ...	Poles ...	,, ...	Do. ...	,, ...	each ...	0-3
254	,, ...	,, ...	Logs Round 5′ and over in girth.	Ballarshah Depôt, G.I.P. Ry.	See 13 ...	Feby. 1924	,, ...	2-12 to 3-12
255	,, ...	,, ...	Logs Rough Squared 5′ and over in girth.	,, ...	Do. ...	,, ...	,, ...	3-0 to 4-0
256	,, ...	,, ...	Logs Round 4′ to 4′ 11″ in girth.	,, ...	Do. ...	,, ...	,, ...	2-0 to 3-0
257	,, ...	,, ...	Logs Rough Squared 4′ to 4′ 11″ in girth.	,, ...	Do. ...	,, ...	,, ...	2-8 to 3-2
258	,, ...	,, ...	Logs Round 3′ to 3′ 11″ in girth.	,, ...	Do. ...	,, ...	,, ...	1-8 to 2-2
259	,, ...	,, ...	Logs Rough Squared 3′ to 3′ 11″ in girth.	,, ...	Do. ...	,, ...	,, ...	1-11 to 2-5

Teak for sale was not of best quality.

260	,, ...	,, ...	Poles under 15″ girth.	,, ...	Do. ...	,, ...	piece .	1-3					
261	,, ...	,, ...	Poles 15″—20″ girth.	,, ..	Do. . .	,, ...	,, ...	1-8					
262	,, ...	,, ...	Poles 20″—24″ girth.	,, ...	Do. ...	,, ...	,, ...	2-0					
263	,, ..	,, ...	Poles 3″ D. × 12′ and over.	Godhra and C. Udaipur	See 20 ...	Novr. 1923	score ...	10-0					
264	,, ...	,, ...	Scantlings small ..	,, ...	Do. ...	,, ...	c.ft. ...	1-8	to	2-4			
265	,, ..	,, ...	Scantlings large ...	,, ...	Do. ...	,, ...	,, . .	2-8	to	4-0			
266	,, ...	,, ...	Small logs ...	,, ...	Do. ..	,, ...	ton ...	50-0					
267	,, ...	,, ...	Big size logs ...	,, ...	Do.	,, ...	,, ...	80-0					
268	,, ..	,, ...	Fire wood ...	,, ...	Do. ...	,, ...	,, ...	7-0	to	10-0			
269	Teak	,, ...	Rough squares ...	Calcutta ...	See 36 ...	,, ...	,, ..	147-8					
270	above 6 †† candies.	,, ..	Logs ...	Baypore Depôt.	District Forest Officer, Nilambur.	Feby. 1924	c.ft. ..	2-7					
271	Teak ... above 4 candies.	,, ...	,, ...	,, ...	Do. ...	,, ...	,, ...	2-8	to	3-2			
272	Teak below 2 candies.	,, ...	,, ...	,, ...	Do. ...	,, ...	,, ...	1-10					
273	Teak	,, ..	Short logs ...	,, ...	Do. ...	,, ..	,, ...	1-2					
274	,, ...	,, ...	Poles 1st Class ...	,, ...	Do. ...	,, ...	each ...	1-12					
275	,, ...	,, ...	Scantlings ...	Quilon, S. I.	See 3 ...	Feby. 1924	c.ft. ...	6-4					
276	,, ...	,, ...	Planks ...	,, ..	Do. ...	,, ...	,, ...	6-14					
277	,, ...	,, ...	Logs ...	Itarsi ...	See 6 ...	Septr. 1923	,, ...	0-14	to	2-			
278	,, ...	,, ...	Poles ...	,, ...	Do. ...	,, ...	pole ...	0-12	to	1-0			
279	,, ...	,, ...	Logs ...	,, ...	Do. ...	,, ...	c.ft. ...	2-8	to	3-0			
280	,, .	,, ...	Rough timber 3′ in length.	Sohagpur	Ahmad Husain, Contractor, Sohagpur.	...	...	...		...			
281	,, ...	,, ...	,, ...	,, ...	Do. ...	Septr. 1923	c.ft. ...	1-8					
282	,, ...	,, ...	Sawn timber below 6′ in length.	,, ...	Do. ...	,, ...	,, ...	2-4					
283	,, ...	,, ...	Sawn timber above 6′ in length.	,, ...	Do. ...	,, ...	,, ...	2-12					

Item No.	Trade name	Scientific name.	Description.	Market.	Apply to	Date.	Per	Prices.	
1	2	3	4	5	6	7	8	9	
								Rs.	Rs.
284	Teak I class	*Tectona grandis* ...	Logs ...	Wynad Forest Division	See 35 ...	March 1924	c.ft. ...	1-8-6 to 2-7	Auction.
285	,, II class	,, ...	,, ...	,, ...	Do. ...	,, ...	,, ...	1-2 to 1-4-6	Auction.
286	Teak, C. P.	,, ...	Rough squared logs.	Timarni or Rahatgaon.	The Manager, the Raja Barari Estate, Timber and Saw Mills, Timarni or Rahatgaon *vid* Timarni.	April 1924	,, ...	1-0 to 3-0	
287	,, ...	,, ...	Sawn wood scantlings and planks.	,, ...	Do. ...	,, ...	,, ...	2-8 to 6-0	
288	,, ...	,, ...	Logs of and above 10 c.ft.	Mangalore & Kasargod.	See 18 ...	Feby. 1924	c.ft. ...	2-0 to 3-0	
289	,, ...	,, ...	Logs below 10 c.ft.	,, ...	Do. ...	,, ...	,, ...	1-3 to 1-12	
290	,, ...	,, ...	Sawn scantlings ...	,, ...	Do. ...	,, ...	,, ...	3-12	
291	,, ...	,, ...	* * * * ...	Rangoon ...	Divisional Forest Officer, Depôt and Agency.	April 1924	ton ...	72-14-7	†Auction.
292	,, ...	,, ...	* * * ...	,, ...	Do. ...	,, ...	,, ...	56-13-9	†Auction.
293	,, ...	,, ...	* * ...	,, ...	Do. ...	,, ...	,, ...	44-1-3	†Auction.
294	,, ...	,, ...	* ...	,, ...	Do. ...	,, ...	,, ...	32 0-4	†Auction.
295	,, ...	,, ...	D ...	,, ...	Do. ...	,, ...	,, ...	50-15-0	†Auction.
296	,, ...	,, ...	E ...	,, ...	Do. ...	March 1924	,,	37-7-8	
297	*Thadan* ...	*Grewia latifolia*	Unsawn logs ...	Pollachi, South Indian Ry.	See 12 ...	,, ...	c ft. ...	0-12 to 1-1	
298	*Thitpok* ...	*Tetrameles nudiflora.*	See *baing.*						

299	*Tiwas* ..	*Ougeinia dalbergioides.*	See *sandan.*						
300	*Tun* ...	*Cedrela Toona* ..	Cedar See Red.						
301	*Vellamarudu.*	*Terminalia paniculata.*	See *kindal.*						
302	*Vengai* ..	*Pterocarpus marsupium*	See *bija.*						
303	Venteak ...	*Lagerstræmia lanceolata.*	Unsawn logs ..	Pollachi, South Indian Ry.	See 12 ..	Feby. 1924	c.ft. ...	0-12	
304	White Changlam.	*Terminalia bialata*	Squares ..	Calcutta ..	See 36 ...	April 1924	ton ...	85-0	
	,, ..	,, ...	Scantling ..	,, ..	Do. ..	,, ..	,, ...	90-0 to 140-0	
305	White Dammar.	*Veteria indica* ..	See *dhupa.*						

†† Candi is equal to 800 lbs.

NOTE † Following are the specifications for the Burma Teak quotations which appear above from item No. 291 to No. 296 :—

B-1 or **** : All logs 8 feet and up which contain not more than two standard defects and have a minimum diameter of 15 inches at top end.

B-2 or *** : All logs 8 feet and up containing three standard defects and having a minimum diameter at top end of 12 inches.

C-1 or ** : Logs of all qualities worse than those which would qualify for *** with a minimum diameter at top end of 12 inches.

C-2 or * : Logs of all qualities less than 12 inches top diameter except such as are classed in D.

D : Houseposts.—Small straight logs to meet the demand for houseposts should be placed in this class whether they actually come under any of the above classes or not.

E : Crooks.—Crooked logs suitable for shipbuilding to be placed in this class whether they fall in one of the other classes or not.

1. This list of quotations is issued as a general guide, and neither the Forest Economist nor the officers or firms quoting are in any way bound to prices given in column 9.

2. Further quotations are invited. They are inserted free of charge and should reach the Office of the Forest Economist, Forest Research Institute, Dehra Dun, U. P., by the 8th instant monthly. Even though rates remain the same it is a great help if Divisional Forest Officers send in quotations monthly so that readers then know that the rates are up-to date.

3. Enquiries regarding the technical properties and identification of timbers may be addressed to the Forest Economist, Forest Research Institute, Dehra Dun, United Provinces.

4. Notices of Auctions should reach the Forest Economist by the 8th of the month previous to that in which the auction is to be held.

DEHRA DUN :
The 15th May, 1924.

H. TROTTER,
Assistant Forest Economist.

QUOTATIONS FOR MINOR FOREST PRODUCTS.

Names of Products.	Market for which quoted.	Latest prices received.	Per	REMARKS.
Bees-wax	Calcutta ...	Rs. 45 to Rs. 65.	md.	
,, E. I. Yellow	London ...	††£4 to £4 15*s*.	cwt.	
Belladonna Root	,, ...	††47*s*. 6*d*.	,,	
Camphor—Japan	,, ...	†3*s*. 3*d*.	lb.	
,, ,, ...	Calcutta ...	Rs. 280 to Rs. 300	Fy. md.	Fy. md. = 74 lbs.
Cardamoms—bleached bags	New York	††Rs. 4-11-10 to Rs. 6-11-10	lb.	
Cutch	London ...	††40*s*. to 45*s*.	cwt.	
,, Red Tablets...	Rangoon ...	†Rs. 95	% Viss.	Viss 3·6 lbs.
,, Black ,, ...	,, ...	†Rs. 74	,,	
,, Block ,, ...	,, ...	†Rs. 57-8	,,	
,, Soft ,, ...	,, ...	†Rs. 50	,,	
Elephant Tusks—				
(50 lbs. and above)	Assam ...	Rs. 27-6-3	seer	Auction.
(50 lbs. and up, soft)	London ...	†£80 to £123	cwt.	
Small tusks (under 50 lbs.)	Garo Hills, Assam.	Rs. 20	seer	Local sales.
,, ,, ,, ,, ...	Kamrup Dn., Assam.	Rs. 19 to Rs. 20.	,,	,,
,, ,, ,, ,, ...	Nowgong Divn., Assam.	Rs. 18-5-2	,,	Auction.
Fibres and Flosses—				
Coir Fibre	Calcutta ...	Rs. 5 to Rs. 7-6	md.	In bales of 200 lbs.
Kapok (Floss)	,, ...	Rs. 38-8 to Rs. 40	,,	Do. 165 ,,
,, (Fibre)	London ...	††11½*d*. to 1*s*. ½*d*.	lb.	
Kitool	,, ...	††6*d*. to 1*s*. 1*d*.	,,	
Rhea or China grass	,, ...	††58*s*. to 60*s*.	ton	
Gambier	,, ...	†68*s*.	cwt.	

Gums—Arabic, firsts	New York	†Re. 0-13-8 to Re. 0-14-2	lb.
Kino	,, ...	†Re. 1-10-3 to Re. 1-12-10	,,
Olibanum	London ...	††75*s.* to 95*s.*	cwt.
,, siftings	New York	††Re. 0-4-3 to Re. 0-4-9	lb.
Hides—Cow (arsenic)	Calcutta ...	Rs. 9-8 to Rs. 19-8.	20 lbs.
East India	London ...	†4*d.* to 10*d.*	lb.
Buffalo	Calcutta ...	Rs. 7-8 to Rs. 10-8	20 lbs.
Lac Seed	London ...	††500*s.*	cwt.
Lac (Stick, Kusmi)	,, ...	††210*s.*	,,
Mowra Seed	Bombay ...	No quotations.	
Myrobalans—			
Central Provinces	London ...	†18*s.* 6*d.*	cwt.
Bombay	,, ...	††9*s.* 6*d.*	,,
Indian	Calcutta ...	Rs. 2-8 to Rs. 3-2	md.
,, ...	,, ...	Rs. 3-10 to Rs. 4-4	,, Crushed nuts.
Nux Vomica—Indian	,, ...	Rs. 5-8 to Rs. 6-8	,,
Buttons	New York	†Re. 0-2-4 to Re. 0-2-7	lb.
Oils—			
Eucalyptus	London ...	†2*s.* 1*d.*	,,
Citronella	,, ...	†3*s.* 6*d.*	,,
Lemon	,, ...	†3*s.* 3*d.* to 3*s.* 6*d.*	,,
Lemon Grass	,, ...	†4*s* 3*d.*	,,
Sandalwood	New York	†Rs. 21-5-1 to Rs. 22-1-9	,,
Rosha Grass	Bombay ...	Rs. 19-12	seer
Vetivert Indian	New York	†Rs. 49-3-4 to Rs. 59-0-7	lb.
Red Sanders	London ...	††£12	ton

Names of Products.	Market for which quoted.	Latest prices received.	Per	Remarks
Rosin "F" Grade, American ...	Bombay ...	†Rs. 10-2-3	md.	
,, "G" ,, ,, ...	Calcutta ..	Rs. 60 to Rs. 65	barrel	Barrel = 4 cwt.
,, "G" ,, ,, ...	London ...	†13*s.* 6*d.*	cwt.	
,, "G" ,, ,, ...	Calcutta ..	Rs. 13	,,	
,, I ,, ,, ...	New York	†Rs 19-0 4	barrel	Barrel = 280 lbs.
,, I ,, ,, ...	London ...	††13*s.* 9*d.*	cwt.	
,, K ,, ,, ...	New York	†Rs. 19-2-11	barrel	Barrel = 280 lbs.
,, M ,, ,, ...	,, ...	†Rs. 19-8-4	,,	Do.
,, N ,, ,, ...	,, ...	†Rs. 20-8	,,	Do.
,, WG ,, ,, ...	,, ...	†Rs. 23-4-6	,,	Do.
,, WG ,, ,, ...	London ...	†17*s* 6*d.*	,,	
,, WW ,, ,, ...	New York	†Rs. 24-9 7	,,	Barrel = 280 lbs
,, WW ,, ,, ...	London ...	†17*s.*	,,	
,, Indian Government, Jallo Factory ...	Karachi ...	Rs. 12	md.	
,, ,, ,, ...	Bombay ...	Rs. 12	cwt.	
,, Indian Turpentine & Rosin Company (Clutterbuckganj Factory).	Calcutta ...	Rs. 10 to Rs 10-8	md.	
,, ,, ,, ...	Madras ...	Rs. 11-3	,,	
Rubber, Indian	Calcutta ...	Rs. 15 to Rs. 40	,,	
,, Para	London ...	†1*s.* ½*d.* to 1*s.* ¾*d.*	lb.	
Shellac, T. N.	Calcutta ...	Rs. 128	md.	
,, ,, ...	London ...	†270*s.* 6*d.* to 275*s.*	cwt.	
,, Orange	,, ...	†350*s.* to 370*s.*	,,	
,, A. C. Garnet	,, ...	†270*s.* to 295*s.*	,,	
,, ,, ,, ...	Calcutta ...	Rs. 118	md.	
,, Button pure	,, ...	Rs. 155	,,	
Spices—Pepper, India	,, ...	Rs. 18 to Rs. 20	Fy. md.	
,, ,, Tellicherry	London ...	†4½*d.* to 4¾*d.*	lb.	
,, Cinnamon	,, ...	†11½*d.* to 3*s.*	,,	
Tamarinds—Indian	Calcutta ...	Rs. 3 to Rs. 7	md.	
Thymo	London ...	††14*s.* 6*d.*	lb.	

Turpentine—			
American Spirit Spot	London ..	†77*s.*	cwt.
Blundel & Co.	Bombay ...	Rs. 8-4-9	gallon
Standard Oil Co.	,, ...	No quotations.	...
Hubbuck's Genuine	Calcutta ...	Rs. 7	gallon
Turpentine, Indian Government, 5 gall. drum (Jallo Factory).	Karachi ...	Rs. 31	5 gallon drum.
,, ,, ,, ...	Bombay ...	Rs. 31	,,
,, Indian Turpentine & Rosin Company 5 gall. drum (Clutterbuckganj Factory).	Madras ...	Rs. 30	,,
,, ,, ,, ...	Calcutta ...	Rs. 32	,,
Wood Pulp—			
Chemical	London ...	†£12 10*s.* to £ 19	ton
Mechanical (moist)	,, ...	†£4 5*s.* to £4 15*s.*	,,
,, (dry)	,, ...	†£8 12*s.* 6*d.*	,,

NOTE.—† Represents rates for April 1924.

Md. indicates Bengal Maund which is equal to 82 lbs.

Prices not cross-marked in the third column are the latest market rates.

†† Represents rates for March.

DEHRA DUN, U. P.:
The 15th May 1924.

H. TROTTER,
Assistant Forest Economist.

PUBLICATIONS RELATING TO INDIAN TIMBERS.

1. Manual of Indian Timbers, by J. S. Gamble, M.A., C.I.E., F.L.S., F.R.S.

2. Sylviculture of Indian Trees, by R. S. Troup, M.A., C.I.E., I.F.S.

3. Indian Forest Utilisation, by R. S. Troup, M.A., C.I.E., I.F.S.

4. Commercial Guide to the Economic Products of India, by R. S. Pearson, F.L.S., I.F.S.

*5 Hand Book of Forest Products of Burma, by A. Rodger, I.F.S.

6. Indian Woods and Their Uses, by R. S. Troup, M.A., C.I.E., I.F.S.

7. A Note on Antiseptic Treatment of Indian Timbers, by R. S. Pearson, F.L.S., I.F.S.

*8. A Note on Andaman Timbers, by Martin & Co.

9. Notes for the Use of Consumers of Forest Products in the Punjab.

*10. A Further Note on the Antiseptic Treatment of Timbers by R. S. Pearson, F.L.S., I.F.S.

11. Results of the Antiseptic Treatment of Sleepers, by R. S. Pearson, C.I.E., F.L.S., I.F.S.

*12. Bamboos for Paper Pulp, by R. S. Pearson, F.L.S., I.F.S.

*13. Bamboos for Paper Pulp, by W. Raitt, F.C.S.

*14. Paper Pulp Supplies from India, by W. Raitt, F.C.S.

*15. Seasoning of Timbers, by R. S. Pearson, F.L.S., I.F.S.

16. Relative Strength of Nature and Plantation Grown Teak.

17. Further Experiments in the Air-Seasoning of Timbers & General Recommendations as to Seasoning Methods, by C. V. Sweet, B.S., M.F.

18. Note on Gumhar (*Gmelina arborea*).

*19. Note on Bija Sal (*Pterocarpus Marsupium*).

*20. Note on Sain (*Terminalia tomentosa*).

*21. Note on Benteak (*Lagerstræmia lanceolata*)

*22. Note on Sandan (*Ougenia dalbergioides*).

*23. Note on Dhaura (*Anogeissus latifolia*).

*24. Note on Blackwood (*Dalbergia latifolia*).

*25. Note on Dhauri (*Lagerstræmia parviflora*).

*26. Note on Sundri (*Heritiera minor*).
*27. Note on Red Sanders (*Pterocarpus santalinus*).
*28. Note on Babul (*Acacia arabica*).
*29. Note on Kokan (*Duabanga sonneratioides*).
*30. Note on Hollong (*Dipterocarpus pilosus*).
*31. Note on Pyinma (*Lagerstræmia Flos-Reginæ*).
*32. Note on Indian Sumach (*Rhus Cotinus*).
*33. Note on Haldu (*Adina cordifolia*).
*34. Note on Odina Wodier.
*35. Note on Semal (*Bombax malabaricum*).
*36. Note on Burmese Leza Wood (*Lagerstræmia tomentosa*
*37. Note on Carallia Wood (*Carallia integerrima*).
*38. Note on Petwun (*Berry Ammonilla*).
*39 Burmese In Wood (*Dipterocarpus tuberculatus*).
*40. Burmese Padauk (*Pterocarpus macrocarpus*).
*41. Andaman Marble or Zebra Wood.
*42. Note on Gurjan (*Dipterocarpus turbinatus*).
*43. Note on Thingan (*Hopea Odorata*).
*44. Note on Kindal or Hongal (*Terminalia paniculata*)
45. Mechanical, Physical and Structural properties of wood grown in India.

46. Summary of results of Treated and Untreated Experimental Sleeper laid in the various Railway Systems of India brought up-to-date, by R. S. Pearson, C.I.E.

*47. Interim Report on the work under Project No. 1 and No. 6 by the Section of Timber Testing including the results of the Mechanical and Physical Tests on certain of the commoner Indian Timbers up to end of 1922.

The above publications are obtainable from

THE SUPERINTENDENT, GOVERNMENT PRINTING, INDIA, Calcutta; and Messrs. Thacker Spink & Co., Calcutta.

A limited number of those marked with an asterisk are available for issue to *bonâ fide* enquirers from

THE FOREST ECONOMIST,
FOREST RESEARCH INSTITUTE, *DEHRA DUN.*

N.B.—**Copies of Item Nos. 2, 4, 6, 17, 18, 29, 43, 45 and 46 can also be had on payment from the Librarian, Forest Research Institute and College, Dehra Dun, U. P.**

NOTICE.

The Conservator of Forests, Utilisation Circle, U. P., has approximately 16,000 *Terminalia tomentosa (Asna)* M. G. Sleepers $6' \times 8'' \times 4\frac{1}{2}''$ at the Government Depôt, Clutterbuckganj, for which immediate offers are requested as the clearance of the Depôt is desired. The Depôt has siding to the O. & R. Ry. at Clutterbuckganj and R. & K. Ry. at Izatnagar.

2. Passing may be carried out at Clutterbuckganj by Railway Passing Official or will be carried out, if desired, by the Conservator of Forests, Utilisation Circle, U. P., Bareilly.

3. Arrangements can, if desired, be made for loading and despatching on rail. Offers may kindly be sent for price F. O. R. Clutterbuckganj Depôt.

F. CANNING,
Conservator of Forests,
Utilisation Circle, U. P.

North-Western Railway.

(CARRIAGE AND WAGON DEPARTMENT.)

Supply of Timber.

—: o :—

The following quantities of timber will be purchased during the year 1924-25 for the Carriage and Wagon Department, North-Western Railway, Moghalpura, delivery to be effected before the 31st October, 1924 :—

Teak Timber (Moulmein or Rangoon)	...	2,000 tons.
Bija Sal and Asna	...	1,750 „
Deodar	...	800 „
Bottom Boards	...	20,000 Nos.
Breast Bars of Sal Wood	...	5,000 „
Burma Teak Scantlings	...	25,000 c. ft.

For further particulars, please apply to the Carriage and Wagon Superintendent, North-Western Railway, Moghalpura.

Statement showing the quantity and value of the different descriptions of timber, other than railway sleepers, imported by sea from abroad into the different maritime provinces of British India during the month of March 1924.

Share of Province.	Deal and pine wood.		Teak wood.		Other timber.	
	Cubic tons.	Rs.	Cubic tons.	Rs.	Cubic tons.	Rs.
Bengal	60	13,139	...	..	10	2,672
Bombay	412	55,809	941	1,30,398	190	16,468
Sind...	70	9,035	...	...	6	551
Madras	...	...	...	...	297	13,136
Burma	...	...	...	...	159	13,294
Total ...	542	77,983	941	1,30,398	662	46,111

COASTWISE EXPORTS OF TIMBER FROM BURMA.

Statement showing the quantity and value of Teak Wood and other timber exported coastwise from Burma to the different maritime provinces of British India during March 1924.

Provinces to which exported.	Teak wood.		Other timber.	
	Quantity	Value.	Quantity.	Value.
	Cubic tons	Rs.	Cubic tons.	Rs.
To Bengal	4,665	6,96,103	1,106	1,27,485
„ Bombay	16,836	10,17,825	69	6,992
„ Madras	7,970	11,28,482	40	3,955
„ Sind	3	950	22	1,617
Total ...	29,474	28,43,360	1,237	1,40,049

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